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The INSTITUTION *of* PRODUCTION ENGINEERS

JOURNAL

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SOME ASPECTS OF THE PRODUCTION ENGINEER'S PROBLEMS IN THE POST-WAR RE-ESTABLISHMENT
H. W. Bowen, M.I.P.E., M.I.Mech.E.

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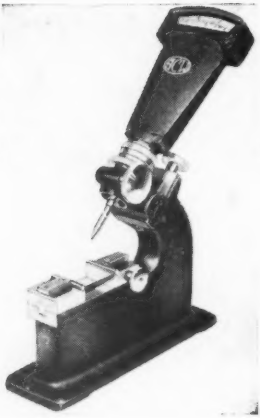

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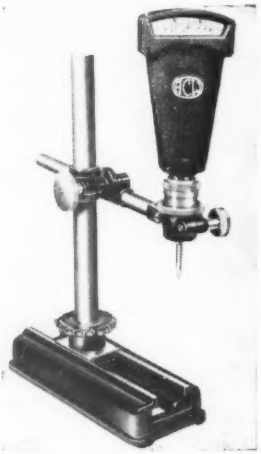

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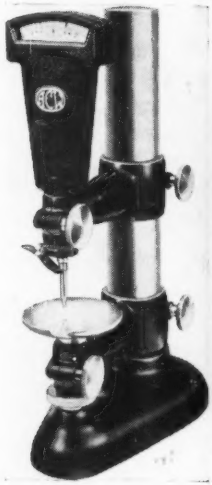

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SIR ROBERT McLEAN

After graduating B.Sc. in Engineering at Edinburgh University, Sir Robert McLean joined Sir Robert McAlpine & Co. as Assistant Engineer in 1904. In the following year he went to India as Assistant Engineer in the Permanent Way Department of the Indian Railways. He was subsequently concerned with the maintenance of the Eastern Bengal State Railways ; responsible for the surveying of a system of light railways in the Punjab Canal Colonies, and in charge of a Survey for a railway connecting India and Burma via Arakan. He also held other important appointments in India.

His war service commenced with the Mesopotamia Expeditionary Force in 1915-1916 when he was responsible for military railway construction and survey. After a period of special war duty with the Government in India in 1916-1917 Sir Robert McLean served with the Royal Engineers in France until 1919. He then returned to India and after a period as Deputy General Manager of the Great Indian Peninsular Railway, he was appointed General Manager of that Company. About this time he was responsible for the first railway electrification in India, and for the first organisation of an Indian Railway on Divisional lines. He was knighted for public services in 1926 and retired from the service of the Indian Government in 1927.

On returning to this country Sir Robert McLean became Chairman of Vickers (Aviation) Ltd., being associated with the outstanding performances achieved by Vickers Aircraft particularly between 1929 and 1931. He was appointed Chairman of the Society of British Aircraft Constructors in 1937, and from 1935 to 1937 was Managing Director of the Gramaphone Co., Ltd., and the Columbia Gramophone Co., Ltd. From 1941 he was Managing Director of Electrical and Musical Industries, Ltd., until he retired in March, 1944.

SIR ROBERT McLEAN (President)

INSTITUTION NOTES

December, 1944

1945.

January Meetings.

4th Leicester & District Section. Dr. D. F. Galloway will lecture on "Production Engineering Research," at the Leicester College of Technology, Leicester, at 7-0 p.m.

4th Yorkshire Graduate Section. Mr. R. W. Whittle, M.I.P.E., will lecture on "Amortization and Obsolescence," at the Great Northern Hotel, Leeds, at 6-45 p.m

8th Coventry Graduate Section. E. B. Wall, Grad.I.P.E., will lecture on "Wage Incentive Systems," at the Coventry Technical College (Room A5), at 6-30 p.m.

9th Wolverhampton Graduate Section. Mr. N. Matthews will lecture on "Principles of Foundry Practice," at the Walsall Technical College, at 7-0 p.m.

12th London Graduate Section. "Questions and Answers Evening," at the Institution of Civil Engineers, at 6-45 p.m

13th Preston Section. Mr. H. Eckersley, M.I.P.E., will lecture on "Negative Rake Milling," at The British Northrop Loom Co., Ltd., Blackburn.

13th Manchester Section. Works visit to The National Gas and Oil Engine Co., Ashton-under-Lyne, at 2-15 p.m.

15th Derby Sub-Section. Mr. P. Russell will lecture on "Cast Iron from the Machinists Point of View," at the School of Art, Derby, at 6-30 p.m.

18th Glasgow Section. F. G. Hewitt, Esq., will lecture on "General Survey of the Production of High Tensile Steel Wire and Wire Ropes" at The Institute of Engineers & Shipbuilders, Glasgow, C.2., at 7-15 p.m.

19th Eastern Counties Section. E. C. Cousins, Esq., will lecture on "Plastics" at the Lecture Hall, Electric House, Ipswich, at 7-0 p.m.

19th London Section. Mr. F. H. Perkins will lecture on "Training Within Industry," at the Caxton Hall, Westminster, S.W.1. at 7-0 p.m.

20th Halifax Section. A. Sykes, Esq., M.I.P.E., will lecture on "Developments in Gear Cutting and Finishing Processes," at the Technical College, Hopwood Lane, Halifax, at 2-30 p.m.

20th Shrewsbury Sub-Section. Inaugural Meeting.

20th Nottingham Section. Mr. G. Windeler will lecture on "Mechanical mishaps and their Relation to Design and Workshops," at The University College, Nottingham, at 3-0 p.m.

January Meetings—*continued.*

20th Wolverhapton Section. Works visit to John Sankey & Sons, Ltd., Bilston, at 2-45 p.m.

24th Wolverhampton Section. C. A. J. Taylor, M.Sc., A.R.I.C., will lecture on "Some Aspects of Modern Industrial Coatings and Post-War Synthetic Finishes," at the County Technical College, Wednesbury, at 6-30 p.m.

24th Manchester Section. R. Whibley, Esq., will lecture on "Some Aspects of Modern Precision Grinding," at the College of Technology, Manchester, at 7-15 p.m.

25th North Eastern Section. T. B. Maddison, A.M.I.P.E., will lecture on "Production Methods in Railway Shops," at Melville Hall Mining Institution, Newcastle-on-Tyne, at 6-15 p.m.

26th Coventry Section. G. Parr will lecture on "The Future of Television," at the Coventry Technical College, at 6-30 p.m.

26th Manchester Section. R. Whibley will lecture on "Some Aspects of Modern Precision Grinding," at the Mechanics Institute, Crewe, at 7-15 p.m.

26th Lincoln Sub-Section. Mr. Fox and Mr. Smith will lecture on "The Outline of Modern Die Forging Practice," at the Lincoln Technical College, at 7-0 p.m.

27th Yorkshire Graduate Section. Works visit to David Brown & Sons, Penistone, 2-30 p.m.

28th Luton, Bedford & District. George B. Tinker will lecture on "Electric Furnace Brazing," at the Central Library Meeting Room, George Street, Luton, at 10-0 a.m.

31st Cornish Section. W. A. Cook, will lecture on "The Utility of Plastics to the Engineer," at Camborne School of Mines, at 7-15 p.m.

February Meetings.

1st Leicester & District Section. W. Swift, will lecture on "Negative Rake Milling" at the Leicester College of Technology, at 7-0 p.m.

3rd Manchester Section. R. Whibley will lecture on "Some Aspects of Modern Precision Grinding," at the Liverpool University, at 2-30 p.m.

6th North Eastern Graduate Section. Discussion Evening on Production Brains Trust, at Melville Hall Mining Institution, Newcastle-on-Tyne, 6-15 p.m.

7th Manchester Section. Film entitled "First Principles in Grinding," at the College of Technology, at 7-15 p.m.

12th Coventry Graduate Section. Any Questions Evening at The Coventry Technical College, Room A5, at 6-30 p.m.

February Meetings—*continued.*

15th Glasgow Section. Brains Trust, at The Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, at 7-15 p.m.

16th Lincoln Sub-Section. Mr. H. W. Pinder will lecture on "Recent Development in the Application of High Speed and Carbide Tools," at the Lincoln Technical College, at 7-0 p.m.

16th Derby Sub-Section. Mr. R. E. Fenton will lecture on "Machine Tool Developments at the School of Art, Derby, at 6-30 p.m.

22nd North Eastern Section. Open at the Melville Hall Mining Institution, Newcastle-on-Tyne, at 6-15 p.m.

23rd Coventry Section. Dr. D. F. Galloway will lecture on "Production Engineering Research," at the Coventry Technical College.

25th Luton, Bedford & District. H. C. Town will lecture on "Hydraulics as Applied to Machine Tools," at the Central Library Meeting Room, George Street, Luton, at 10-0 a.m.

28th Cornish Section. W. G. Morgan will lecture on "Modern Foundry Practice," at the Camborne School of Mines, at 7-15 p.m.

28th Manchester Section. S. C. Roberts will lecture on "Costing as Applied to Production," at the College of Technology, Manchester, at 7-15 p.m.

March Meetings.

1st Leicester & District Section. T. G. Pearcey, F.G.W.A. will lecture on "Financial Management of Small Engineering Firms" at the Leicester College of Technology, at 7-0 p.m.

6th North Eastern Graduate Section. J. W. Pringle, Grad.I.P.E. will lecture on "Measurement and Control of Temperature in Furnaces," at Melville Hall Mining Institution, Newcastle-on-Tyne, at 6-15 p.m.

10th Halifax Section. T. P. N. Burness, M.I.P.E., will lecture on "Production Methods as Applied to Machine Tools," at the Huddersfield Technical College, at 2-30 p.m.

12th Coventry Graduate Section. A meeting has been arranged at the Coventry Technical College, Room A5, at 6-30 p.m. (Details to be announced later.)

15th Glasgow Section. A. C. McDonald, B.Sc., will lecture on "Modern Heat Treatment," at The Institute of Engineers and Shipbuilders, Glasgow, C.2., at 7-15 p.m.

16th Manchester Section. H. W. Inshaw will lecture on "Advantages of Using Plastics," at The Mechanics Institute, Crewe, at 7-15 p.m.

March Meetings.—*continued.*

16th Eastern Counties Section. Lecture on "Jig and Tool Symposium," at the Lecture Hall, Electric House, Ipswich, at 7-0 p.m.

19th Manchester Section. G. Goddard will lecture on "Machining Light Alloys," at The College of Technology, Manchester, at 7-15 p.m.

19th Derby Sub-Section will hold a Film Evening arranged by the Ministry of Production, at the School of Art, Derby, at 6-30 p.m.

22nd North Eastern Section. L. Walker, M.I.P.E., will lecture on "Heavy Machine Tools," at the Melville Hall Mining Institution, Newcastle-on-Tyne, at 6-15 p.m.

23rd Coventry Section. A. G. Askew will lecture on "Modern Gear Production," at the Coventry Technical College, at 6-30 p.m.

24th Manchester Section. W. Puckey, M.I.P.E., will lecture on "Management in Action," at the Liverpool University, at 2-30 p.m.

25th Luton, Bedford & District Section. R. C. Fenton will lecture on "Negative Rake Milling," at the Central Library Meeting Room, Luton, at 10-0 a.m.

28th Cornwall Section. Dr. D. F. Galloway, B.Sc., will lecture on "Production Engineering Research," at the Camborne School of Mines, at 7-15 p.m.

30th Lincoln Sub-Section. Mr. R. C. Schuster will lecture on "Reconditioning of Machine Tools," at the Technical College, at 7-0 p.m.

April Meetings.

5th Leicester and District Section. The Annual General Meeting will be held at Leicester College of Technology, at 7-0 p.m.

25th Manchester Section. W. D. Jones will lecture on "Powder Metallurgy," at The College of Technology, Manchester, at 7-15 p.m.

27th Coventry Section. Annual General Meeting will be held at Coventry Technical College.

27th Lincoln Sub-Section. Annual General Meeting, followed by a paper by Dr. Galloway on "Production Engineering Research," at the Lincoln Technical College, at 7-0 p.m.

29th Luton, Bedford and District Section. Dr. D. F. Galloway will lecture on "Machine Tool Research and Development," at The Central Library Meeting Room, George Street, Luton, at 10-0 a.m.

May Meetings.

11th Eastern Counties Section. Brains Trust, will be held in the Lecture Hall, Electric House, Ipswich, at 7-0 p.m.
North Eastern Section. General Meeting and Works Visit to Messrs. Noble & Lund, at the Melville Hall Mining Institution, Newcastle-on-Tyne. Date to be announced later.

Conference between Technical and Publications Committee and Section Secretaries.

A conference between the Technical and Publications Committee and the Section Secretaries was held at the Queen's Hotel, Birmingham on 8th November. A full report of the proceedings is being sent to all Section Presidents and Secretaries.

The chairman of the Technical and Publications Committee, Mr. Alastair McLeod, presided, and in opening the conference said that the reason for calling it was to bring the various sections of the Institution into closer friendship with headquarters and each other. He said that the conference was an experimental one and expressed the hope that periodical meetings of a similar character might ensue from it, by means of which all sections of the Institution might be brought into close relationship and collaboration.

The documents before the conference included a list of technical subjects of topical value to engineers and a memorandum on Full Employment. These subjects and the general organisation of section meetings were then fully discussed.

Derby Sub-Section.

The Sub-Section at Derby was inaugurated on 20th November, when Mr. H. J. Swift was installed as first Chairman of the Sub-Section by Sir Robert McLean, President Elect of the Institution. The platform party included ; Mr. J. E. Blackshaw (Chairman of Council), Mr. Hyde-Trutch (President Nottingham Section), and other officers of the Institution. Over 200 members and visitors attended the meeting.

Shrewsbury Sub-Section.

The inaugural meeting of this Sub-Section to the Wolverhampton Section will take place on 20th January. Further details will be announced later.

Newly Elected Members.

As Members : V. W. Bone, J. Blackiston, T. G. Bamford, S. Bramhall, A. Chisholm, H. J. Dolman, H. Denham, T. Dooley, J. P. Fox, G. A. Firkins, A. Gaunt, C. F. Hammond, C. E. Jones, A. F. Kelley, Sir R. McLean, W. R. Paddon, G. R. Pickles, T. E.

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H. G. Tillotson, E. Taylor, A. W. Tilbrook, A. Tutty, J. Wilkins, F. W. Whitworth, G. Ward, D. L. Wiggins, W. H. Ward, J. Wood.

As Graduates: E. M. Bellamy (when of age), R. M. Cooke, T. K. Dinsdale (when of age), W. R. Dowle, J. Dunkerley, D. H. Gladwell, G. W. Grundy, A. D. McL. Hill (when of age), H. W. P. Hatton, K. F. J. Inman, F. T. James, N. W. Jones, H. Kellett, D. V. Luke, K. H. Maddison T. P. Macklam, J. Parry-Jones, R. H. Revett, J. H. Saunders, D. G. Steel, N. E. Wall, H. Whiteley, R. B. Williams.

As Students: F. W. Beeken, J. W. Bates, W. M. Brady, A. A. Boxall, R. J. Broomer, H. E. Cornish, J. L. Carter, W. S. Chipping, C. Chamberlain, G. E. Crick, N. S. Cheetham, A. B. H. Davies, J. W. Eagle, S. W. Edmunds, G. Fenwick, G. Fox, I. R. Fellows, E. C. Gregory, L. R. Griffin, J. A. Gough, J. R. Gay, A. K. Goodlad, C. H. E. Gillott, G. L. Goodwin, K. C. Heath, A. H. Hancox, B. Hollington, R. B. Hesselden, J. E. Horncastle, K. D. Heagarty, J. L. Hughes, J. Howarth, A. J. P. Johnson, A. Jackson, R. C. Kinsley, K. E. Limbert, A. Lofthouse, E. N. Lloyd, T. Marsden, J. B. Morton, L. C. Neville, B. E. O'Connor, H. L. Palmer, N. R. Pratley, E. J. Rabson, R. F. Skidmore, A. S. Sault, S. G. Spate, E. J. Statham, R. J. Slide, F. L. Smith, R. N. Smith, C. Taylor, J. Toplis, G. L. Tredwell, P. Warburton, R. G. L. E. Wallace, J. I. Williams, J. N. Walton, R. Wallis, G. Wheway.

As Affiliated Firms: Chilton Aircraft (Aff. Rep.: A. Dalrymple, F. Holmes); Albion Motors (Aff. Rep.: Wm. McFarlane).; A. Duckham & Co. Ltd. (New Aff. Rep.: G. Joyce); The English Electrical Co. (Aff. Reps.: L. J. Sarjeant, W. M. Hurton, E. M. Price, A. Sheffield, J. W. E. Milligan, J. K. Brown, H. G. Nelson.); F. A. Hughes & Co. (Aff. Rep.: L. B. Whitburn); Noble & Lund, Ltd. (Aff. Rep.; Harry Noble); Peglers Ltd. (Aff. Rep.: Charles M. Smith); Sydney Technical College (Aff. Rep.: H. J. Swain and Miss E. A. Sims); J. Sagar & Co. Ltd. (Aff. Rep.: J. G. Sagar); Welding Supplies Ltd. (Aff. Rep.: L. A. Lidstone); J. Williams & Sons (Cardiff) Ltd. (Aff. Rep.: H. J. B. Williams, Aubrey Williams).

Transfers.

From Associate Member to Full Member: C. H. Benbow, T. S. Crabtree. S. O. Hicks, W. Hall, H. S. Hull, N. C. Robertson, J. Walters, B. W. M. Wakefield.

From Intermediate Associate Member to Associate Member: J. Baxter, A. E. I. Bond, A. V. Elson, C. K. Hughes, E. S. Moore, H. C. Perry, C. H. Readman, J. D. Smith, J. A. Walker.

From Graduate to Associate Member: A. J. Batten, F. T. Dyer, T. J. Davies, D. H. Milnes, B. Morris, P. H. Newman, J. Oliver.

From Graduate to Intermediate Associate Member: G. Butler, E. R. Baller, D. G. Galpin, C. Hayward, R. T. Lewis, C. H. Samson, J. C. N. Thompson.

From Student to Graduate: L. J. Beard, W. Chapple, G. J. Laing, S. Metcalfe, C. F. Millington.

Obituary.

COMMANDER SIR CHARLES CRAVEN, R.N. We deeply regret to record the death of Sir Charles Craven who was an Honorary Member of the Institution. His contribution to Britain's industrial effort entitled him to be regarded as one of the country's most outstanding engineers.

Contributions to the Research Department.

The Council gratefully acknowledge the undermentioned contributions which were received during the month of November.

	£	s.	d.
Marshall Sons & Co., Ltd.	50	0	0
Vauxhall Motors Ltd.	100	0	0
J. Legge & Co., Ltd.	5	5	0
	£155	5	0

BOOK REVIEWS

Higher Control in Management, by T. G. Rose. Published by Messrs. Pitman. (Price 15/-).

This, the fourth edition of a book published nine years ago under the title of "Higher Control," contains certain additions found more advantageous from a more extended experience in the use of the method, and in particular there are considerable additions to the chapter dealing with the "technical position," which has been rewritten round a chapter previously entitled "Works Control." With this edition the title of the book has been altered to "Higher Control in Management" in order to make it clear from the outset that the method is first and last solely a basis for the intelligent management of industrial and commercial undertakings, and that it is not in any sense a text book on accountancy.

Mr. Rose insists that management must be based on comparison, and for this purpose some standard is required against which comparisons may be made. The measuring rod in higher control is the moving annual total, and this enables orders and sales, income and expenditure, profits and losses to be compared month by month against the results of the past twelve months. Higher control therefore can be defined as a monthly survey of the functional

activities of a commercial undertaking carried out from the business, technical, trading and financial viewpoints, based upon direct comparison between the position at the moment and the position at the last financial year. The use of such trends enables fluctuating results to be compared and controlled with a degree of accuracy which would be impossible if only monthly figures were used. Higher control differs from Budgetary control because it records what is actually happening, whereas budgetary control sets out beforehand the theoretical ideal and then records what is occuring under departures from that ideal.

Mr. Rose's book will well repay close study, and it is to be strongly recommended both to students of the subject and those engaged in the practical problem of securing effective control of industrial enterprises.

Production Control in the Small Factory, (B.S.1100 : Part 2. 1944) Published by The British Standards Institution. (Price 2/-.).

" Production Control in the Small Factory " is part of a series of booklets on office aid to the factory being published by the British Standards Institution. The compilation of the information contained in Booklets No. 1 and 2 was undertaken by the Production Control Sub-Committee of the Institution of Production Engineers.

The latter booklet although small, covers a fairly wide field in Production Control in condensed form.

It sets a basis for the small manufacturing concerns who wish to avail themselves of the information in formulating a Production Control scheme in their own particular factory.

Books Received.

Interchangeability of Parts and Quality Control, by T. P. B. Burness, M.I.P.E. ; *Training for the Metallurgical Engineering Industries*, (Birmid Industries Ltd.) ; *Machining of Wrought Alluminium Alloys*, (W.L.A.D.A. Bulletin No. 7) ; *Examples in Engineering Drawing*, by H. Binns, A.M.I.P.E.

SOME ASPECTS OF THE PRODUCTION ENGINEER'S PROBLEMS IN THE POST-WAR RE-ESTABLISHMENT

Paper presented to the Institution, London Section, on 14th April, 1944, by Mr. H. W. Bowen, M.I.P.E., M.I.Mech.E.

THE people of the Commonwealth, during the present disaster of a second world war, are of one mind, which is a fixed and determined purpose to fight the enemy with every resource, material and mental, until we beat him.

Their decision is that when peace comes it must be permanent and secure, which means that the enemy must be crushed and conquered beyond dispute. Unconditional surrender is our objective and nothing short of this can possibly be acceptable if we are to achieve our purpose.

The trend of the war has now taken a much more favourable turn, and as we are definitely on the offensive in all operational sectors we feel that we can, without lessening our efforts in any way, stop for a few moments to look ahead on the post-war horizon and try to visualise that transition period between war and peace, and attempt to view the immense problems that will have to be tackled by the Production Engineer in switching British Industry from war- time production to the normal civilian requirements of peace.

This war has been distinctly an engineer's war, wedded to the efforts of the scientist, and the engineer in British Industry has undoubtedly contributed a great deal in saving the country in those dark critical days when the gleaming light of victory was nowhere to be seen. If, in those days, the engineer could contribute, then I submit that in the future, this country will depend more upon the engineer in industry than she has ever done in the whole of our history.

I consider that the Production Engineer and British Industry should state their case to the Government and tell them what they expect in the post-war era and how they intend to face their problems

It has been a noticeable fact that leading Politicians, Industrialists and Trade Unionists have made many speeches on the peace-time condition as related to the war-time condition, but to the best

of my knowledge no leading public figure has made a concise statement with regard to the transition period between war and peace.

In this paper I am going to deal principally with the problems of this period.

It is quite legitimate, in attempting to foresee the post-war future, to :

(*a*) Anticipate that the European war will conclude before the Pacific war.

(*b*) Anticipate that world hostilities will cease completely.

If the European war ceases first we shall possibly have time to change over partially to supplying a part of the great civilian post-war demand, and, at the same time, part of our industry will be kept busy supplying the weapons and materials of war to satisfy the demands of the war against Japan. If this happens, it is possible that the transition period will be more gradual, which will indeed be a decided help in settling some of the major difficulties.

If, on the other hand, world hostilities cease completely at the same time, the transition period will be much more difficult, and in our planning this is the stage we should discuss, because if industry has a clear conception of how to deal with this particular phase, it is reasonable to assume that the easier phase as depicted under (*a*) can be accommodated by a modification of the methods of dealing with phase (*b*).

Peace.

Twice in the lifetime of most of us, Germany has waged war, causing misery and devastation in countries other than her own. In the last war, we granted her an armistice before the war had reached her soil, so actually she suffered little or no material damage within her own country. In this war, this has been changed due to the gallant actions of our airmen. Many of her cities, including her capital, have been attacked and seriously damaged, and the horrors of war have been brought home to her people. This is all to the good, but it seems to me that this will not, in itself, kill the military lust of the Germans.

We depend on our statesmen this time to make the necessary arrangements for a secure and lasting peace, including the military occupation of Germany and Japan. The trade of these countries must be controlled in such a way that they cannot again embark on a programme of preparation for aggression. The commercial methods of these aggressor countries must be examined and controlled so that they will not carry on the various forms of illicit methods upon which Germany embarked in the pre-war years to carry out the trade war.

These points are the responsibility of the statesmen to study, calling on the advice of our leading economists, but until these points are properly safeguarded it is useless to plan on the basis of a permanent peace.

Before we discuss the problems of post-war, two questions loom up very largely on the horizon, which have been the basis of political discussion for some considerable time. They are questions of very vital interest to the Production Engineer, and he cannot find answers to any of his post-war problems until clarity is reached on these two questions, so I will dwell on these points first.

The first is Private Enterprise and the other is Controls.

Private Enterprise.

It is probable that industry of the future, excluding those industries which perform services where monopoly can be justified as being in the best interests of the community, will exist in the form of what is popularly known as private enterprise.

In war-time, when all the resources of the country are harnessed together as a team, concentration towards one objective is necessary, but in peace-time, when industry has to use its own initiative to produce and take the necessary risks to meet competition, state control would have a stultifying effect which would in the end ruin industry.

The profit motive is the main wickedness which is put on the door of private enterprise, but it must be remembered that profit is a very small portion of the selling price at the factory, and many, including the state, benefit very largely by the skill in management of the production engineer who produces the goods to make a profit. We pay bonus to the workman as an incentive to effort, with good results, and this is wholly accepted as a good maxim ; why then is industry as a whole criticised for working efficiently towards the incentive of profit ? I maintain that engineers within the confines and by the aid of private enterprise helped to save the country in those darkest days ; indeed, if it had not been for private enterprise, we should have entered this war without either the Spitfire or the Wellington. I name these examples only, but this does not exhaust the list by any means. There are hundreds of other examples which cannot be made available until the war is over.

I hope that we shall be able to face the future in a way that our Production Engineers can tackle their problems without undue political interference. Possibly some measure of state control will be necessary for a time after the cessation of hostilities, but we hope that every effort will be extended to abandon this control as soon as possible.

Controls.

At the close of hostilities, humanitarian principles demand that the Allied Nations should first concentrate on the immediate relief of the stricken countries. These countries will require food and clothing and possibly medical relief. The necessary stocks of essential commodities for this relief will have to be accumulated and because of the demand, both in this country and for relief purposes, the Government will have to control the distribution. It will also be necessary to re-establish in these stricken countries, as well as in our own, the buildings, plant and raw materials necessary for making the communities self sufficient in the services necessary for the life of the nation, so that the necessity for the extent of relief from external sources can be eased and that conditions can come back to normal as quickly as possible.

After this comes the raw material, plant and building necessary to supply the demand for the comfort and the economic development of our home land.

Many manufacturing firms at this time will be contemplating breaking into new fields of production, probably diametrically opposite to anything they made prior to the war. At the same time, a large number of new companies will be opening up to manufacture the more simple type of products of civilian demand.

Owing to the limited raw material position which is envisaged, this state of affairs, if allowed to come about, can only lead to chaos. The scramble for raw materials would be intensified and you would be building up a manufacturing position which, after you had reached the peak stage of production in satisfying domestic demands, would ultimately create a position of redundancy of manufacturing capacity.

To enable this position to be kept within the bounds of reason, it is surely not too much to suggest that no manufacturer should be allowed to commence immediately the production of any form of engineering product which is in no way related to the product which he had been manufacturing previous to the war. This can be done by being made statutory that any firm who wanted to commence a new line of manufacture which was foreign to their pre-war manufacturing structure, or any new firm which wished to enter the manufacturing field, would require to be licensed by an appropriate Government authority. The idea which lies behind this suggestion has much to recommend it from the point of view that :

(*a*) It insures that those firms which already manufactured a line of goods previous to the war would be the firms which would continue to manufacture the goods after the war and, therefore, they would have a preference in the raw material market ; in fact,

you could go as far as to say that the issuing of raw material to such firms would be based on a proportionate basis of their pre-war manufacture.

(*b*) That from the general public's point of view, it would insure within reason that the type of product which was being put on the market was value for money, because the companies who were manufacturing would have had the necessary experience.

(*c*) That it would give the best utilisation factor for the raw material supplies which will be available.

The argument which will be immediately brought up against this suggestion is the obvious one, that you are permitting by this means a monopolistic position to creep into the engineering industry, and if the scheme were carried out indefinitely, that argument would be substantially true. It is only necessary to remember that in the introductory remarks to this paper it was clearly stated that we were dealing only with the transition period and not with the settled peace conditions. Surely if we accept this factor, then we must agree that during this period it does give a measure of control in the industry. It is equally obvious that this set of conditions applies principally to the light engineering type of industry as it will not be the same scramble in the heavier types of engineering, including structural work, which will require, no doubt, to expand to meet the post-war demands.

What we must emphasise is that our post-war plan must be so designed to achieve and maintain a high level of National production in the post-war years and also to avert a post-war inflation in the immediate transition period, followed by a devastating depression.

Towards this end we would accept Controls until the demand for consumers' goods which have not been procurable during the war becomes reasonably stable, and to avoid being involved in the terrific scramble for raw material and supplies in the immediate post-war transition period.

If we accept all this, Controls for Controls sake must never be allowed ; all Controls must be brought to an end as quickly as possible to allow industry and trade to operate normally in the shortest possible time.

Change-Over Considerations (Layouts).

To the firms on Government contracts, the closure will become operative with the application of the contract break clause. From this point, I expect the main difficulty will be for the Supply Ministries to find store places where the finished, partly finished, and redundant material can be delivered to allow the firm to clear their floors for their peace-time production. The firm which is carrying on its war-time work without having changed their normal layout is

lucky indeed. In any case, it can be expected that the Government requirement specification will vary quite widely from the firm's own peace-time product. This means that the jigs, tools, fixtures and gauges for the Ministry contracts will again be unsuitable for the normal peace-time production, and it means that the old left-over jigs and equipment of pre-war vintage will have to be found, examined and checked against operation lists to see if all are available on normal work.

Machinery has been kept running night and day for five years with the bare minimum of maintenance, so the machines must be examined now to see what can be done to avoid delay in the early step-off. It is fairly obvious that a large majority of these machines will be so worn out that they will have to be replaced. It is not likely that new machines will be available at once, but the decision should be made and orders placed with the Machine Tool suppliers as soon as possible, as there is always the danger that we are apt to keep on using the partially worn-out machine even if it is uneconomical to do so until the machine eventually comes to grief entirely, leaving us in the lurch at a time which is most embarrassing.

From the layout point of view, I say to the Production Engineer that this is your chance to put things right. I am sure there was something about that layout that could have been improved had you thought about it in time. You had committed yourself; you knew it could have been considerably improved, but if you had faced it then, production would have dropped and it would have cost money and it was hard to justify. Directors ask awkward questions, don't they? I know I sympathise with all that, but face it. If you cannot justify it now when you are starting afresh, then I cannot imagine you will ever be able to justify it.

Layout dictates the flow and efficiency of manufacturing methods and operations, and is usually so inflexible that once laid down is generally fixed, hence great care and thought should enter into the planning of the layout. Good and well planned layout of machinery assembly and departments generally allow for the efficient progression of work to scheduled times and avoids those jams and bottlenecks which are the bane of the Production Manager's life.

The well-planned layout is based on the study of the article manufactured, broken down to its lowest common parts list and operation sheets, so the sequence of study of the layout should be based on :

1. A study of the design and the sub-divided varieties of design of the product, together with sub-assemblies and spare parts or service requirements over a definite period of manufacture.

2. Determination from the operation sheet of the list of operations, machinery and assembly in their proper sequence, together

with a complete list of materials, and its relation to the available equipment so that a decision can be made what equipment has to be bought or made and what finished parts or sub-assemblies will be bought outside.

3. Study the rate fixing estimate so as to calculate the time interval between operations. This will enable an estimate to be made of operator labour required and give an indication of plant balance and what area will be required for work in progress storage space.

4. The advice of the Chief Inspector should be taken to cover the question of inspection, both final and detail, and the position of his operative which will, in most cases, be dependent on the type and circumstance of layout. The Inspection Department is important and should always be consulted at an early stage of layout.

In considering the product for manufacture, this is probably the time to consider such important points as :

Standardisation of detail.
Standardisation of material.
Reduction of inspection to a minimum.
Saving of floor space wherever possible.
Ensuring the route flow of work and avoiding unnecessary transport and handling.
Watching your Stores and trying to arrange the production flow to bring work in process to the lowest practical minimum.
Studying your layout to see how you would handle a stoppage on the line due to any cause whatsoever.
I cannot imagine that the old days will come again when you could send labour home in the case of stoppage without a week's notice and this situation will have to be faced.

At this stage, ask yourself the questions :

(*a*) Are your machine tools in good condition ?

(*b*) Is the equipment of the right type ?

I have not discussed layout from the point of view of unit flow, straight line flow, continuous or repetition or intermittent, as I consider that the fundamentals are very much the same although certain of the problems will occur in lesser or greater degree according to the type of layout considered.

The production planning and the paper-work is very important and should be organised to suit the circumstances. This includes the efficient control of material, stores requisitioning, buying and issuing, inspection of incoming raw materials and purchased parts ; well organised system to cover machine loading, works orders, operation planning, progressing, scheduling, checking, packing and despatch.

A good layout well organised will always pay good dividends in a higher rate of production with improved quality of product, and at the same time, due to a more efficient utilisation of labour and equipment, will cut down the overall production times, which means cheaper costs.

Government owned plant which was supplied to you on loan to carry out some specific contract must also be under consideration at this stage. It is possible you have an agreement which will enable you to have first refusal of the purchase of this machinery. If the machines have been properly maintenanced and if the machines are really of use in the post-war period, it might pay you to come to an agreement with the Government and purchase the machines. I certainly would not advise any engineer to buy a machine because it is cheap unless you have a real and immediate use for it ; if you only visualise a use at some future date you should spurn the temptation to buy immediately and wait until the time comes, and then you should be able to justify a new machine.

Buildings repairs have been neglected during the war, and a great deal will need to be done when hostilities cease. We must also remember that building labour and materials will be very much in demand for the repair of bomb damaged property, the building of homes for the population and the returning soldiers, so I can forsee that the Ministry of Works, or some other Ministry, will have a grip on this situation for quite a number of years. In any case, something will have to be done for industry, and proper representation will have to be made to the Government to see that this want is justly satisfied. Blackout will be the first attention, and this will be removed, I hope, for ever. Then there is electric wiring and supply ; this should be carefully examined and repaired if necessary at once. Paint might be in short supply for some time, but any painting and decorating that can be conveniently done should be done as soon as possible. There is nothing like a good clean fresh start to meet commercial competition and new paint always makes a place look fresh and clean.

Labour.

The war period has brought a tremendous influx of personnel into industry, and it can be said that it will be impossible to employ as many in a post-war era, and if so, it is equally obvious that the number of people required during the transition period of, say, 2 years, will be still less. Even if the married women and directed labour leave industry at the end of the war, the number of employees still left in industry will be a great deal more than the number required for the immediate change-over. Coupled with the fact that we cannot employ the personnel which is already in the factories, we shall be faced with a further problem of absorbing into

industry the men and women being demobilised from the Services, as well as disabled persons. It must be clearly understood that the legal situation will demand that employeers should employ a proportion of disabled people. Even with controlled demobilisation, I doubt if it can be retarded to the extent of meeting the altered position in industry.

Now to summarise this problem, we must face the fact that we shall have :

1. An inflated personnel in the engineering industry as soon as the war is over.

2. We shall have to absorb into industry, which is already over-manned, the personnel released from the Forces.

Before we can tackle any problem successfully, we must face facts, and here we must face the unpleasant but definite fact that as far as the engineering industry is concerned, we shall have redundant personnel. This redundancy will be immediate, and as far as I can see it will be at least two years before the engineering industry can even absorb the personnel which is its normal peacetime quota.

In this delicate period, the Government and industry must collaborate and each undertake their responsibilities and consult with each other to relieve this position as rapidly as possible.

As far as I can visualise, an early move will be the partial easement of the Essential Works Order, which will allow directed labour who wish to leave industry and return to their domestic duties to do so without delay. Another contemplation may be the retirement of all personnel employed in industry at present over the age of 65, with pension.

It is essential that the Government should adequately plan for the immediate starting-up of industries which have been operating at reduced rate during the war with as little delay as possible. There must be the immediate re-establishment of concentrated firms who have been obliged to cease their normal manufacturing activities. Such industries as textiles, food stuffs, building trades and all allied production units, as well as many others too numerous to mention, should be got under way as soon as possible. This is obviously where the Government planning will help, and where a large part of the excess unskilled and semi-skilled personnel in the engineering industry can be temporarily accommodated.

If we take the blackest picture, we may find that the engineering industry for the first two years cannot absorb its skilled personnel because of the facts which I have already outlined. The problem of the skilled workers is a difficult one, as it would obviously be a waste of skill to train the personnel in other activities for only a temporary period. Again, the Government can assist the retention

of skilled personnel in industry during the transition period by releasing as much contractual work as possible to the industry to maintain as many as possible of the skilled personnel in work.

If sufficient work cannot be found to keep all the skilled workers continuously employed, it may be necessary to reduce temporarily the working week until such time as normal conditions had been reached.

Therefore, it is obvious that a great deal depends upon the Production Engineer, in as much as the sooner he brings his plans into operation so as to reduce the transition period, the sooner can the problem of the labour utilisation be solved. Furthermore, the Production Engineer in industry has a responsibility to the community to plan the utilisation of labour in such a way as to cause as little unemployment as possible, and to assist the Government, who will be tackling the problem nationally, by rapidly turning over his own unit to normal working.

After 5 years or more of war, when our fighting men return to industry, they will have to be carefully and sympathetically treated. Their war experience will have brought about a condition which will be akin to war weariness, which will need a considerable amount of re-adjustment when they again enter industry. That this condition will show itself is only to be expected, and with the great incentive of fighting for one's own existence and in support of our own friends and relatives, lapse of morale is inevitable unless we can supply a new motive force.

The principles that have been instituted to maintain morale during war-time must be continued, but adjusted to peace-time conditions.

Welfare, then, will have to be a permanent factor in industry.

As we have already stated, it will be necessary to absorb into industry those who have been injured physically, and, to some extent, mentally, and have suffered some permanent degree of impairment from that injury.

The Ministry of Labour has laid it down as its programme that no man or woman should be debarred employment because of some physical defect acquired or inherited, and they will rely on employers to co-operate to that end.

Recently, Mr. Bevin opened the " Back to Work " Demonstration, covering this subject, where he assured every injured workman the opportunity of treatment and full employment ; that the injured, due to war or civilian service would be absorbed in work which they were capable of doing, and that means would be provided to employ those suffering physical handicaps, either from inheritance or illness. He said that the Government would set up training centres and treatment centres to help these people to fit themselves

for their future livelihood. In his talk he definitely stated that he wished the factories to be his first line of treatment, and he expected the assistance of the Production Engineers to devise and develop methods in the factory, such as special jigs, tools, etc., for the benefit of disabled workers.

In this he was promised full support by the Employers and Trade Union Organisations.

Then it is the responsibility of industry and the factory to provide and develop methods in order to provide the means of progressive employment for the disabled worker where he is capable of improvement. This, more than anything else, will help in the complete re-instatement of the injured by the removal of any feeling of permanent limitation of achievement.

Here I suggest that throughout training and employment, together with welfare, contact of the right type will play a useful part, and I venture to think that the medical services in the factory will be able to help in no minor way.

The social side of post-war reconstruction has been under discussion for a considerable time and apprehensive questions are being asked by workpeople all over the country. These people have memories of the years following the last world war with their disillusionments and frustration, mass unemployment with its attendant poverty and unfulfilled hopes.

We won the last war and made an utter failure of the peace that followed, leading us only on to the catastrophe of another war more terrible than the first.

We must not make these mistakes again in our plans for reconstruction ; we must think well about the problems of labour utilisation.

Conclusion.

I have only touched the fringe of some of the problems of the transition period, and I have kept as far as I could strictly to the problems of the Production Engineer. The financial problems, the problems of distribution and the questions of export and import all come under review, but I did not consider that these were relevent to this paper ; they are not altogether the Production Engineer's business, although they effect him indirectly.

It is essential, in questions dealing with production, utilisation of material, machinery and labour, that the Production Engineer should make himself heard and advise the Government wherever he can, because that is his duty to himself and the community.

I have no doubt that some of the matter which I have dealt with this evening is controversial ; I do not expect general acceptance of all I have said, but I put it forward as a basis of general

discussion so that we, as an Institution, can have the opinions of all members in the most important problems which we shall have to face, I hope, in the very near future. If we think about them now and plan, then the problems will become clearer. Perhaps our plan of today will not be the correct one, as the conditions will have changed so radically that we shall have to scrap it. It will be a very bad plan indeed if you have to scrap all of it—I think it is most likely that you will have to modify some of it. It is very much easier to build or modify a plan previously thought out than to try to prepare a scheme in a hurry which has to be put into action without proper thought.

We shall win this war, but in so doing we shall have used up our wealth. We are not a self supporting country ; in fact, we are perhaps, as a Nation, the best customers in the world. After this war, Britain will have to tighten its belt, we shall have to work harder, we shall have to meet foreign competition and increase our export trade. As we have to import to live, we shall have to balance it by our exports. Our standard of living in this country has always been high and we want to try and keep it high. Experience has shown that we cannot maintain a high standard of living without a dynamic economy, with a full development of all our productive resources, material and human.

The bonds of common interest to one fixed objective which has linked Government, people and industry together in this war, regardless of station or political creeds, have been so remarkable and so successful that it augers well for the future. If the bonds still hold and the political factions can be curbed until the main crisis is overcome, I feel sure the problems can be conquered and we shall get over our transition period in the minimum of time and the maximum of efficiency.

I am confident that this condition will be met and that our democratic systems, based as they are upon a concept of the sanctity and worth of the individual, will triumph.

I have faith in our engineers and leaders of industry, in the traditions of freedom and self reliance into which they were born and in the institution under which we live.

Discussion

THE CHAIRMAN, in opening the meeting for discussion, said the paper was most topical. The subject was one which was exercising the ingenuity of many people—Statesmen, Associations, Federations and Institutions. The result was that there was being presented daily an almost continuous stream of blue-prints, most of which purported to be the ideal plan for this or that in the post-war period.

There were many facets to the question of re-establishment; they ranged from the highly scientific to the highly political. He wished to pay tribute to the masterly fashion in which Mr. Bowen had extracted just those which concerned the production engineer. As Chairman of the meeting, he asked contributors to the discussion to confine their remarks to the scope of the Institution because if they confined their remarks to production engineering the maximum benefit from the production engineer's point of view would be obtained from the discussion.

MR. ALBU thought Mr. Bowen was to be congratulated on his courage in facing such an enormous task.

In spite of the Chairman's remarks, he was afraid Mr. Bowen had been unable to keep the scope of his paper entirely within the production engineering field; but after all, they were citizens as well as production engineers. He did not think the solution of the problem rested in their hands as production engineers although they would have to work out the head-aches of whatever solution was finally proposed.

Mr. Bowen had said he believed and hoped that industry would remain under private enterprise after the war. The majority of it would. The main problem which would face the country after the war would be in two stages; first, to get industry back to a state of full peace-time industrial production with a minimum period of chaos; and secondly, having reached that state, to maintain it—to maintain a condition of full economic activity and full employment. There was hardly a person in the country today who believed that that could be done in any way other than by Government planning and control. Mr. Bowen had said that he believed in that planning and control; in fact the whole of his paper was an appeal for it during the transition period. Even Lord McGowan, the Chairman of Imperial Chemical Industries, had said he did not believe that full employment could be maintained without a Government economic policy for the maintenance of employment, because only the Government could ensure that there was full consuming power

and a level of investment necessary to ensure that our resources were fully employed. That was of fundamental importance.

When one came to the period with which Mr. Bowen chiefly wished to deal, *i.e.*, the transition period, the experience of the last war was to some extent a guide. After the last war there was a period of chaos for some six months or so ; then there was a period of boom for about a year and a half in the engineering trade. In that period the boom went to a very high level, but it was followed by a disastrous slump after which trade picked up again. He did not propose to go into the economic and financial reasons for that, but he agreed with Mr. Bowen that it would be necessary to control industry during that period in order to prevent the boom getting out of hand as it did after the last war and in order to prevent it becoming a speculative boom in which prices would rise enormously. After the last war prices rose some 50 per cent, and in some places even higher.

It was obviously necessary to ensure that industry did not again go through the ghastly period of that slump. If it was to be done, it had to be done in some way which protected the public. He was not very happy about Mr. Bowen's suggestion of licensing new entrants to industry because if those were private entrants a monopolistic condition was being created. He thought the way in which it would be done would be by a continuation of the rationing of material and control of investment to ensure that there was not speculative investment in those trades in which there was a very short term demand. That would provide a protection for those firms who were already manufacturing products and would also protect the consumer.

He thought it would be necessary to maintain control over costs and prices during the transition period ; otherwise there would be created a situation in which there would be an enormous demand, nobody else could come in and prices would rise.

He was very glad that Mr. Bowen had touched on what was going to be a most important thing for production managers in the future, as it had been in the past, namely, the human factor. It had been very much neglected in the past and as a consequence we had suffered greatly during the war. Nothing could be worse for the country than that the industrial relations within the engineering industry should be those which prevailed at the time of the slump which followed the boom of the last war. Everybody knew what was meant by that and everybody knew the legacy with which we entered this war—a legacy of bad industrial relations in the engineering industry.

Everybody knew of the number of young men who went out of the industry because of the bad conditions within it. When he was serving his time boys came into the industry at 14 or 15 and went

out into the building trade at 16. Many employers had said it was a ghastly thing that they did then. That was a factor of the utmost importance. When industry got over that intermediate period (if it did), and if, as he hoped and believed, there would be planning for full employment, it would be faced more than ever with the human problem.

Everyone had heard the bitter comments of their workers of production managers and works managers. They were extremely short-sighted; they attacked their workers and sometimes they attacked Mr. Bevin and the Essential Works Order. But lack of discipline in workshops—if there was a lack—was not caused by Mr. Bevin; it was caused by a shortage of workers. If that situation continued, as it would do under conditions of full employment, new methods of managership would have to be understood by production engineers; they would have to be traineed to understand that the management of human beings was just as important and much more difficult than the design of jigs and tools. If that was to be the case—and he believed it was—a great deal more attention would have to be paid to that problem. Of course, if there was not full employment industry could return to the old conditions until the economic security that people wanted did not exist and the political stability necessary for our revival would have disappeared.

Some people said that we needed to export in order to live. That was not true. We had, however, to export in order to import the food and raw materials which we needed. There, he believed, was where Government control was going to come in. It was quite clear that we could not continue to import from countries which were unwilling to take our exports in return. The question then arose of what type of things we were going to export in the future. The country could not continue to rely and the light engineering industry could not continue to exist on the backs of the old exporting industries such as coal and cotton as had been done in the past, in the hope that somehow or other their trade would revive. They could not. We could not continue to export goods in which a very high percentage of the cost was imported raw material and in which the cost of labour was proportionately lower. The same applied to coal, where the proportion of skilled labour was comparatively low. Countries industrialising for the first time, as the Eastern European and Eastern Asian countries were going to do, were going to start, just as we did 150 years ago, on the simple processes in which the raw material constituted a large part of the cost and the skilled labour a comparatively small part.

What had we left to export? We had our skill. After the war we would have to export those articles which continued the highest degree of technical skill and workmanship and in which the cost of imported raw material was low; we could not rely on marketing

inferior articles which could be produced by cheap labour. We had to produce goods, therefore, in which the amount of research and development was very high indeed. That meant that there would have to be a very high degree of skill in their production and consequently production engineers would have to take a very great interest in research and in the improvement of the present very low level of technical education. Technical education, he thought, was mostly needed in the higher ranks of management and in the lowest ranks of the craftsmen. It was up to production engineers to raise the educational and technical standard of the members of their Institution and of those who were going to fill the posts in their profession. He urged them not to be frightened of improving the educational and technical standards of those people who were going to have their jobs in ten years time.

MR. ARMSTRONG said the President had referred to what was going to happen to labour and had suggested that a certain amount would be redundant. The previous speaker had talked about technical education for the young. He was interested to know whether there was at present any indication of what was to be done with those adolescents who would be coming into industry during the period of redundancy. His memory went back a little further than that of the previous speaker, and he knew that it had been a difficult task to get the best labour.

All his life he had been interested in the education of engineers. He thought they had reached the stage when they had to watch that their young people did not get into small groves, because they had some fine men who, if they were properly led and properly developed, could take their places in ten years time. If they planned on the right lines, they had good material with which to go forward.

MR. MELTON remarked that possibly a very important factor had been lost sight of in expecting that the British engineering industry was necessarily going to be called upon to meet the wants of the world. The British people were perhaps flattering themselves when they thought that they alone possessed the necessary skill, particularly when an enemy such as opposed them at the present moment had demonstrated that he too possessed engineering skill. If the enemy populace was to live, they also had to live on their skill.

A previous speaker had mentioned that our imports were balanced by our exports in coal and cotton goods. Those had been lost—some through our own folly and others through the natural tendency of power production. He was referring to hydro-electricity, etc., of which there was an illustration in Italy.

It had been said that products requiring greater skill would be in

demand, but no mention had been made of what kind of product was envisaged. That was important, because the product that required a great deal of skill might not be in great demand. Were there any?

If the British were going to remain in the engineering field as an important nation they had to possess the production possibilities of those countries which had been compelled by the war to go into production—engineering production largely. In Australia, New Zealand, India, Africa—in fact in all the Colonies—there were expensive plants, and many other countries had developed an engineering industry of their own owing to British inability to supply them.

He thought one had to be very careful in thinking that Britain was going to maintain even 50 per cent of its production capacity prior to the war.

PROFESSOR TRUMAN explained that he was to some extent connected with Government control at the moment. He therefore could not be accused of being biassed when he said that he believed in private enterprise. It was true that during the period of transition about which Mr. Bowen had been talking there was bound to be some measure of control of some kind; but industry would have to look to its laurels in competition with foreigners in addition to competition within the boundries of this country and for that reason it was necessary that it should have freedom of action, that it should be untramelled by the controls which the Government would exercise blindly, if it exercised them at all, for each industry knew its own business best.

One protected a child while it was young; but if one maintained that protection while the child grew, if one wrapped it up in the cotton wool which was appropriate to its early weak years, one continued the child in its weakness. Its strength and its ability to live was not developed and eventually it was not in a position to meet that competition in the world of men it would be called upon to meet. The same applied to industry. He therefore subscribed most whole-heartedly to the view that there should be a removal from industry of Government control in the main as early as possible, although he realised it might have to be retained in certain instances.

However much one hoped and prayed that this war would be the last, he submitted there was not an earthly chance of that being so if this country did not plan to defend itself on the off-chance of this war not being the last. Arrangements would therefore have to be made for either a national or an international force—probably the latter. He wanted to know Mr. Bowen's views as to the part that industry, our industry would play in keeping up the development of

the equipment of the force or forces required. A motor car manufacturer, for example, might well interest himself in developing a motor car suitable to appeal to the tastes of private motorists here, in the Dominions or in foreign countries; but was that motor car manufacturer also going to be required as a bounden duty somehow or other to interest himself in developing not only a paper knowledge of but an actual nucleus of production ability to meet possible Service requirements if they were unfortunately to rise again?

MR. DYSON considered it was indeed encouraging to hear such a prominent engineer staking the claim of the production engineer in industry in the future, particularly in view of the fact that so much had been heard—probably quite rightly so—of the views of organised labour and, to a certain extent, of industrial federations.

The subject of the paper was indeed controversial. He could not altogether agree with the lecturer on the question of restrictions on new firms entering industry or on existing firms taking on the manufacture of new products. Surely any firm which in five years of war had not improved its efficiency and so developed itself as to be in a position to undertake new products had not got very far. He thought he was right in saying that a large number of the companies which were today successfully supplying the needs of war were in fact new firms or firms entering on new products at the end of the 1914-1918 war. If those firms had not come into being, the country might not have been in the happy position in which Mr. Bowen had stated it was. He thought the line of approach to the problem should be along the line of measuring and considering the productive efficiency of existing firms, some of which might not measure up to recognised standards. It was possible that those firms would not continue in business.

He had been extremely interested to hear Mr. Bowen bring up the question of machine tools, because that was one of the fundamental aspects so far as the production engineer was concerned. They were the great concern of the production engineer at the beginning of the war and might also be his great concern at the beginning of the peace. A thing which worried him was that enemy and enemy-occupied countries, whose factories had been and would be demolished, would obviously set up their factories with new plant and equipment. What was the British equipment going to be like which would have to compete with it?

There was one thing which had to be considered when the question of re-equipping plant with machine tools came up; that was that it was not sufficient merely to replace them with new tools of the same type as those worn out. It would be necessary to consider new processes. In fact the modern large scale production factory

might have no capstans, milling machines or lathes but would in all probability have moulding, coining, etc., machines. It would not do to forget new developments when re-setting up plants.

Personally he believed that industry was passing through a phase where organising ability was not up to the standard of productive ability. He thought it would be well to pay a great deal of attention to the question of utilising the organising ability of the production engineer to find a correct method of measuring the efficiency of his factory and of correctly measuring and assessing requirements of labour and machine tools, because it might not be unreasonable to suggest that employers would be asked in the post-war era not to pay labour by the insecure method of an hourly rate but to provide security by means of a weekly wage.

Lastly, he thought the Institution of Production Engineers should pay attention to the question of developing the right outlook for exporting skilled British engineers to the Commonwealth—not to other parts of the world. The Commonwealth would need a number of skilled engineers and if Britain did not supply them possibly some other large industrial country would.

THE LECTURER explained that his attitude to control was that control in industry was necessary during the transition period, but for guidance and not for restraint. As long as controls could be regulated in such a way that they did not put a restraint on private enterprise he did not think anyone could complain, but as long as they were putting a restraint on production they were of no use.

On the question of the licensing of firms, he asked Mr. Dyson to consider his own firm, which had broken into war work whole heartedly and which had broken right away from its own products. Knowing the distribution methods of that firm he did not suppose it could possibly happen, but if it were possible and another firm broke in and started manufacturing the products which Mr. Dyson's firm had manufactured so efficiently for years whilst he was equipping his plant, having done all he could to help the national effort, it would be most unfair. That was a possibility. If previous to the war a firm had been manufacturing a commodity and if during the war it sacrificed that commodity in the public interest consideration should be given to that firm to enable it to re-establish itself in that commodity. That was his idea when he suggested the licensing of firms. There might be a better way of doing it, but he did not know of one.

Mr. Albu had dealt with the export of products requiring a great amount of skill in their manufacture and he very largely agreed with him. In fact, taking it generally, there was not very much on which he could disagree with him. British industry had got to look to its laurels as far as research was concerned and it had to be in a

position to manufacture in the future products which could not be manufactured by the comparatively unskilled countries.

Mr. Armstrong had asked a question regarding the education of the engineer. There was a lot of research going on even now in many of the old engineering firms. Engineering firms which thought anything of their people were overhauling their educational systems and their apprenticeship schemes and bringing them up to date. Education was very much in the air at the moment. He thought there was no doubt that after the war the engineering industry would be able to deal with adolescent engineers ; it would be able to look after them and train them. It would not be a case of putting a young man on a capstan and leaving him there for three years or more ; he would have to gain experience in every department.

It was quite possible that the skill in the engineering industry was not as great as the skill in some other industries, but Mr. Melton would realise that he had been confining himself to the production engineering aspect. He thought that taking everything into consideration the engineer in this war had shown a degree of skill which had been of great help in the defence of the country ; he referred to the manufacture of aeroplanes, tanks and guns, amongst other things. Firms which had been making some very simple article were now making articles of a complex nature. The engineer had earned a few laurels and deserved a pat on the back, but, as Mr. Melton had said, there were other trades quite as skilled as the engineer's trade, and probably more so.

MR. MELTON said it was not a question of skill as between respective trades but a question of the skill of the engineer in respective countries. The engineer had nothing to fear from other trades ; they could offer no competition. The man who made silk hose could offer no competition to the man who turned out machine tools.

THE LECTURER said the production engineer in this country had shown up very well indeed in comparison with, for example, the American engineer. It was impossible to say how he compared with the German engineer. There were very good German engineers and Italian engineers, but he did not feel he could enter into a discussion on the relative merits of engineers in different countries.

MR. MELTON explained that that was not his point. His point was that one should not lose sight of the fact that those countries were in a position to produce products of engineering. Therefore the country could not look to engineering to supply the exports to meet the cost of the imports which was previously met by the export of coal, cotton goods and so forth.

THE LECTURER thought he had answered that by saying that the industry had got to indulge in research to find out new products of

a highly skilled nature, as, for instance, some of the new radio products.

MR. MELTON pointed out that the people from whom we bought wheat simply would not have the money to buy television sets.

THE LECTURER said it had been asked what industry was going to do to defend the nation after the war. He thought it would be agreed that during the period when the Government should have been looking after armaments in this country, private enterprise did bring forth the Spitfire, the Wellington, and so on. That point had been brought out in his paper. During the course of the war private enterprise had brought forth the Mosquito. Those things were common knowledge, but the members knew of many more which could not be mentioned at the meeting. Industry had helped in the defence of the country in this war ; no doubt it would continue with research and would bring forth other innovations, which, if the Government were bright enough to accept them instead of sitting back, thinking about them and letting them go to other countries, would benefit the community as a whole.

He agreed with Mr. Dyson on the necessity for the modernisation of plant and thought much could be done in that direction.

Before the war he would have agreed that organising ability was not in line with productive ability, but he thought there had been an improvement, for industry could not have achieved its present high rate of production without organising ability. The designing of a jig was part of the organisation, as was the designing of a machine. There had already been an improvement in that direction and it might be that that improvement would continue.

As to labour, he did not think that after the war labour would permit conditions to be such that when a line was shut down they had to go off for, as an example, four hours until it was again in operation. He thought a week's notice would have to be given, but a weekly wage would not be acceptable for labour would probably prefer an hourly wage. Labour would have to be safeguarded and the Ministry of Labour would see that it was.

MR. MARSHALL agreed that this was an engineer's war and that the peace would be an engineer's peace.

During the last war the engineer was a great man. Indeed, it was generally found that during periods when the engineer was in great demand he was a great fellow. He hoped that when hostilities ceased this time the engineer would still be acclaimed to be the great fellow he was at the present moment.

He enquired whether the Lecturer could give any indication as to how the engineer could assert himself in the formulation of the peace as he had been begged to assert himself during the war.

To his mind, the position of the engineer now was not due so much to the lack of apprentices coming into the industry as to what might be termed the niggardly policy carried out by the industrialists of the country. Mr. Bowen opposed Government control, but had there been Government control in the peace which followed the last war the engineering industry would not have found itself in the position in which it found itself prior to 1939. Factories all over the country were closed and became derelict as far back as 1922 or 1923 and some of them remained derelict even until 1940. The machine tools in those factories had been sold for scrap—at scrap prices. The policy all along had been to make no preparation. Those machines could have been brought back into use again, even if they were a little out of date, for in this war half a machine would have been better than no machine at all.

That was his point. Could Mr. Bowen suggest any way in which the production engineer could assert himself to gain a place in the formulation of the peace to which everyone was looking forward ?

THE LECTURER replied that that was a point which had been in his mind for a long time : how could the production engineer assert himself in the post-war period in the same way as he had asserted himself in the war period ?

The Institution of Production Engineers could further the cause of the production engineer better than any other. Although it might be unpopular to say so, he thought that the educational and technical qualifications necessary for admission to the Institution should be so high that only the best men were admitted. Industry would then realise that anyone who was a member of the Institution of Production Engineers was indeed a production engineer and the best of his type. That would be one of the greatest aids that the production engineer could have in the raising of his status. Members would have to insist upon their Council, their Section Presidents and their Sectional Committees seeing that people who were brought into the Institution were beyond question. If they did that, they would be in a position to say to engineering companies : " If you want a production engineer the best place from which to get one is the Institution of Production Engineers, whose members are the best of their type." He wondered whether Members could say that at the present moment with their hands on their hearts. If that could be said it would be of the greatest assistance in getting a Royal Charter for the Institution ; but it could only be said if the educational qualifications were high, if it was ensured that entrants were of the best type and if proposers and seconders did not recommend anybody unless they were certain that he was a production engineer and of a good type.

He was not opposed to controls during the transition period, when there would be a shortage of raw materials. As long as con-

trols were properly used during that period they would be beneficial and would help to prevent chaos, but if they were to be used merely as a means of restraint they should be opposed. Controls, in his opinion, were only necessary in the transition period and should be removed as soon as possible.

MR. MELTON said the Lecturer had raised the question of Government controls. The nation had found itself compelled to impose controls on industry for the protection of its life and people had groused a great deal because it was something new. They probably groused a good deal when compulsory vaccination, schooling, etc., was brought in, but now they had become accustomed to those things they accepted them without question.

The watch industry in Switzerland had been coddled by Government subsidies and controls, but there was no effective competition from outside Switzerland. Controls might have to be modified but the country could not do without them entirely; in fact they were not half as bad as some people thought they were.

He wondered whether people ever stopped to think whether it was fair that the country should call upon the shareholders of the producers, for example, of the Spitfire to do development work for the protection of every British citizen. Surely if the country needed an Army, a Navy, and an Air Force, as it always had done and as it always was likely to continue to do, the development and provision of the equipment of those forces was the business of the State, which could draw on stores of money and knowledge greater than those possessed by any commercial undertaking in the country, great as many of them were.

In conclusion, he thought there was much to be said for control.

THE LECTURER said he accepted what Mr. Melton had said about the Swiss watch industry, although he had no knowledge of it himself.

Government departments would not take risks (indeed it was difficult for them to do so for if they made mistakes there might be political repercussions) but private enterprise could and would, and the country had thereby benefitted in this war. People grumbled when a firm made a profit and alleged that the profit was made at the expense of the community, but they conveniently forgot that that firm had taken risks in order to make that profit. Private enterprise, with its profit interest, has produced many of the things which the Forces were now using and had there been no private enterprise prior to the war the country would not have fared so well. There was, therefore, a great deal of credit attaching to it. He agreed that the production and development of arms was the task of the Government, but although it was doing that now it had not done it in times of peace. That, perhaps, was due to the

action of the Treasury, which would not pay out money unless it was presented with a definite scheme.

MR. O'CONNOR accused the Lecturer of having dodged the issue raised by Mr. Melton, namely, the issue of production. The question of this country's existence was bound up with those of other countries—particularly the big countries such as America, Russia and Germany. He thought, therefore, that the meeting should look into the position of Britain as compared with the position of other States.

The other questions which had been raised were subsidiary to the main one, which was the question of Britain's relations with the countries he had named.

THE LECTURER pointed out that the title of the paper was: "Some Aspects of the Production Engineer's Problems in the Post-War Re-establishment." The subject under discussion did not concern other countries.

MR. O'CONNOR asserted that the future of Britain was largely bound up with the future of America, Russia and Germany. Britain was essentially an exporting country but a country like America (which would probably need no post-war reconstruction) would be able to grab markets in countries such as India.

THE CHAIRMAN pointed out that while he did not necessarily disagree with the point which Mr. O'Connor was making, it was rather outside the scope of the Institution. Production engineers had to assume that other people in their particular spheres would deal with the problems appropriate to those spheres. This meeting had been convened to discuss what the production engineer's aspects of those problems were, and what they could do about them.

MR. PRICE was surprised at the trend which the discussion had taken. Very little had been said about what the production engineer himself could do, although a lot had been heard about what the Government should do, what the Board of Trade should do and what economists should do.

How was the production engineer to win respect? Surely the best way in which he could do that would be to show what he could do.

The paper dealt with some of the problems which should be dealt with immediately. He challenged any production engineer or production manager present to say now how he would face up to his problems if he awakened tomorrow morning to hear that Germany had sued for an armistice overnight. He ventured to suggest that most of them would be caught.

In a recent paper he had seen that America (which was being looked upon as a competitor) had taken a cross-section of her industry. 414 firms had replied, representing all sections of industry. They had outlined what they intended to do in the post-war era. 58 per cent of them had voted for expansion and taking on new products and most of them had gone so far as to double their proposed expenditure on new plant, new ventilation and on bettering conditions in factories. That would give an idea of how America was facing up to the problem from the production engineer's point of view. In addition, they had put a man in every town in the U.S.A. with a population of 10,000 or over. That represented 1,077 individuals, all of whom were collating information to go to a central pool. What had British industry done in the way of collating engineering information? Why could not Britain today be planning new plant? It did not matter what the Government was doing. Although industry did not know what it was going to produce tomorrow, it could at any rate look to its tools and its buildings. The Institution of Production Engineers would have to give a great deal of thought to what it could do today to meet a crisis which might come tomorrow. That crisis was Peace.

MR. GAMMON thought that immediately after the war when the engineering industry changed over from whatever it was producing now—aeroplanes, tanks, guns or torpedoes—and had once more to earn a living in a strictly competitive field it would be glad that controls existed.

He asked members to consider what would happen if the war ended today and they had to decide on the spur of the moment what they were going to produce tomorrow, without some gentleman from one of the Ministries coming along to hold their hands and tell them what they were going to produce. The first thing that would happen would be that there would be a mad scramble for raw materials which were in short supply; they would not be allocated by the Government. Firms would not have time to grumble about the allocation of raw materials; what they would have cause to grumble at would be the fact that there was a shortage and that owing to the absence of restrictions on their supply, prices had risen immediately. He ventured to suggest that then they would almost sigh for the return of the days when controls were in being.

THE LECTURER said he agreed that controls were necessary during the transition period, but he felt that as soon as those peculiarly difficult conditions had ceased to exist the anchor on private enterprise should be taken away and should be allowed to carry on under its own steam.

MR. WESTON felt that one point which production engineers had to consider had not been mentioned; that was transport. When

a factory was being laid out transport had to be considered—what was being made and where it had to go.

The question had been discussed only from the point of view of Great Britain but it had to be considered from the point of view of the Commonwealth of Nations.

What would we transport? He felt that we would transport the skill of the production engineer (which had to be high) and not goods to the Commonwealth.

THE LECTURER agreed that the question of transport was an important one. America, for instance, was building a large number of ships and therefore Britain was liable to lose a lot of its shipping trade.

As far as internal transport was concerned, there was present at the meeting a representative of the Railway who might be able to throw some light on the subject. He himself knew that a lot was being done by the different railway and motor transport companies to cope with the problems of the post-war era.

MR. WESTON explained that that was not his point. He did not feel that Britain would transport goods, but the skill of the members of the Institution of Production Engineers and other Institutions to do the work in other fields.

MR. STUCHBERRY, in moving a Vote of Thanks, said it was a pleasure to have the opportunity of expressing the thanks of members to their President for what might be regarded as a Presidential Address.

There was no doubt that this had been an engineer's war and there was very little doubt that it would be an engineer's peace.

It seemed that the President would be satisfied if he felt that his paper had stimulated discussion and had perhaps made the Institution crystalise some of its ideas so that it had a greater chance of becoming articulate and of contributing to the advice which went to the Government to assist it in the formulation of policies. The Institution of Production Engineers was not going to be frightened into not discussing problems because those problems might be considered to be complex; it would consider any problem on which the ideas and professions of its members enabled it to give advice to the Government in formulating the policies which would inevitably have to be formulated when the war was over.

As to the question of control, it had to be remembered that there always had been control of some sort or another. During the war industry had suffered to some extent from Emergency Regulations and Orders of various kinds, which had in the main been restrictive. The President's view was that the controls of the future would need to be more directive.

There were three sorts of controls. There were the purely restrictive types, which the President was anxious to remove as soon as possible after the transition period had ended. Then there was the type of control which was directive and which presumably had to exist if the country in conjunction with other countries was going to co-operate in world economy. Then there was the type of control which was indirectly restrictive by virtue of its being a set of conditions provided by legislation which was perhaps indirectly concerned with industry—the sort of legislation, for instance, which could control factory conditions, terms of employment and economic conditions generally.

It seemed, therefore, that the object of the evening's discussion had been to make the Institution (or its London Section) realise that it had got to face up to the problems as it saw them and to attempt to define the direction in which action should be taken rather than merely to grumble about conditions as they were.

Industry had to adopt a co-operative attitude in its dealings with labour. If employers were to regard labour merely as something to grumble at on every possible occasion they would get nowhere at all ; they had to take things as they were and see how conditions could be improved. Labour conditions as they existed today were not necessarily to be regarded as final ; they had to be regarded as the commencement of a vastly different state of affairs as between industry and the people who, after all was said and done, made it, namely, the people who worked in it.

It had not been his primary intention to contribute to the discussion but to express the thanks of the meeting to the President for his very excellent paper. It was a paper which would stimulate members into taking a more active part in the formulation of the policy which the Government should adopt in the future.

The Vote of Thanks was carried with acclamation.

ANNUAL GENERAL MEETING

of the Institution of Production Engineers held on Friday, 24th November, 1944

THE Twenty-third Annual General Meeting of the Institution was held at the Wigmore Hall, Wigmore Street, London, W.1., on Friday, 24th November, 1944, at 2-15 p.m. Sir Ernest Lemon, O.B.E., the retiring President, occupied the chair at the opening of the meeting.

Notice of Meeting.

The General Secretary, Dr. K. G. Fenelon, read the Notice convening the meeting.

Minutes of the Previous Meeting.

The Minutes of the previous Meeting were taken as read, were confirmed and signed.

Election of Officers and Members of Council.

The General Secretary read the list of officers and Members of Council who had been elected for the ensuing year. (These are set out in this Journal on the page preceding the Institution Notes.)

Introduction of the New President.

The retiring President (Sir Ernest Lemon) said it was his very pleasant duty to introduce Sir Robert McLean, the new President of the Institution. In handing over his office to Sir Robert McLean he was passing it on to one who had done a great deal of work for the country's good, work which was perhaps not known to many of the members, and he felt sure that Sir Robert McLean would make a very good President. He was very glad that this year the Institution were having an address by the incoming President, as it was so important for the Institution to hear its President's views on the trend of events, and for the members present to take them back to their Sections for further discussion.

Sir Ernest Lemon then vacated the chair, which was taken, by the new President, Sir Robert McLean, amid applause.

Presidential Address.

Gentlemen,—This Institution is younger than the Sister Institutions of the Mechanical, Electrical and Civil Engineers, yet the

functions of the Production Engineers cut across and apply the technical territory of all three in the art and business of engineering production. The profession plays its part in every form of manufacture where engineering methods and processes are used ; it is, in a sense, the bridge between the academic outlook and its application to daily life ; and from the nature of things its relations with labour are so close that it is the first body of men to meet the impact of labour troubles and unrest, whether these are born of industrial or political causes. For five years of war the profession has been in the forefront of the Battle of Supply.—How well it has borne itself will, I hope, be told one day in the Proceedings of this Institution. I myself have seen something of the grim and insistent problems that have had to be tackled and solved. But solved they were—the profession has deserved well of the country. And so I deem it a great privilege, for which I thank you, to fill the office of your President for the year 1944-45.

End of European Hostilities.

We are nearing the climax of the European war. When hostilities will end no one can prophesy. But the end is near enough for us to give serious thought to what lies ahead in the transition period back to normal business and in the more distant period when we try to build up, on sound foundations, a manufacturing structure through which this country can re-establish and maintain its place as a great Industrial Nation and one of the Great Powers.

An emotional approach to these problems is not helpful. The facts will be hard, very hard at times, and it is on this thought that I propose to dwell to-day.

Transition Period.

Firstly as to the transition period, I need only say that if through the cancellation of war contracts without regard to the load on our enterprises, or by a restricted supply of raw materials, a heavy and lengthy drop in physical output takes place, much unemployment will follow, and, moreover, such financial losses may ensue as to prejudice seriously the power of our enterprises to re-enter their normal markets, and, to an even greater degree, to prepare for and compete successfully in world markets. Bearing in mind that the British economy is incomplete and that exports and imports are vital to our existence, the transition should I submit, be adjusted to the needs of Industry, and that includes labour, for a smooth and well planned changeover. I need not elaborate this. The implications will be clear to you all.

Export Situation.

Turning now to the more distant period when the permanent industrial structure of the future is taking shape, we already have

data that throw some light on the problems. And the crux of the whole business is that we are a debtor nation; to live we must import; to import we must export; and to export we must be competitive in our technique and in our costs.

How much then have we got to export at pre-war values firstly to restore our economy to the 1936-1938 level; then to provide raw materials for the higher national income that is involved in work for all with Social Security; and finally to take care of the external debts incurred for purposes of the war, estimated by Lord Keynes at £3,000 million?

Authorities differ, but there are good grounds for putting the national income in the years just before the war at round about £5,000 million. According to the *Economist* exports in the year 1936 to 38 averaged £940 million in value, of which £40 million was deficit and out of the balance of £900 million physical exports had a value of £540 million. Sir John Anderson has warned us that to restore the pre-war position in export markets we must increase our pre-war shipments by 50%. £540 million must therefore become £810 million and it is legitimate to add the 40 million deficit. So we must achieve an increase of £310 million or 57½%.

Such an increase would be a tremendous task if everything were in our favour. But faced as we shall be with technical competition as good as, if not better than ours, and, if one can take pre-war experience, at lower prices, the task will be impossible unless we adjust ourselves to it.

If we succeed we shall merely restore the pre-war conditions. But the country is aiming at an increased National Income to provide employment for all, and increased imports are essential if this is to come about. The National Income required has been estimated at £7500 million. Taking the same ratio of exports to National Income as in the years 1936—1938 i.e., 19% we shall have to export in some form or another exports to the global value of £1425 million at pre-war values. We may reasonably assume that the bulk of this must be physical exports. And so it seems that the long term problem we are tackling is how to increase our 1936-38 figures, not by 50% as has been stated, but by something of the order of 150%.

Evidently this matter of exports is the pivot on which our whole future turns, and new indebtedness will have to wait until we have succeeded or some composition is reached.

Where can the mass of exports be placed and what form of competition are we likely to meet? The natural outlets for consumers' goods are the Continents backward industrially such as Asia and Africa and part of South America. And there will be a demand for capital goods from the Dominions, India and China, and other countries that are advancing industrially.

For consumers' goods the great majority of the uncounted

millions who people Asia and Africa are peasants living on the land and bound to it by religious and social custom and not seldom by their native law. They live in abject poverty by our standards. Their wants are small individually and primitive in character. Quality, as we judge it, does not enter into their minds. Theirs is a price market and they will buy the cheapest article that functions and has fair durability. They are not influenced by the political or social thought of the country of origin of the goods.

As with consumers' goods, so with capital goods. Functional adequacy and cheapness will be the main considerations rather than superfine quality and excessive life at higher prices.

I have noticed that at least one of our Ministers holds out the hope of growing markets from a rise in the standard of living among such people. There is little comfort in this thought. It involves radical changes in land holding and agricultural methods such as will take generations to carry out, even if religious and legal obstacles can be overcome. And the simultaneous transfer of displaced peasants into industry would call for a high level of industrialization, which in itself is a slow process when dealing with a backward population. Even so, it is as well to remember that if that day comes developments in manufacturing and process plant are equally at the disposal of such people to manufacture their own needs. In my own experience they can be trained to a high level of dexterity as operatives, mechanics, fitters and so on.

Competition.

Competition will come from two main sources. Firstly, the progressive industrialization of the backward countries with up-to-date manufacturing equipment, with costs of labour and transport in their favour, and probably behind the shelter of a tariff wall; and secondly from highly industrialised countries who to maintain their industrial load may be prepared to export at marginal prices. Let us recognise that the main competitor is likely to be the U.S.A. in post-war conditions. Industrial and political opinion there has declared itself in favour of an all out drive in export markets, and if from the shelter of its great internal market based on ac omplete economy it exports at marginal cost our wit and competence will be taxed to the limit to get a footing in these markets.

And let us not forget that the American Merchant Navy, representing perhaps half the world's tonnage, will be a serious competitor with our own depleted Merchant Fleet, which has contributed so much in the past to both visible and invisible exports. No one will expect American exports to be carried in British bottoms, and our invisible exports from shipping freights and so on may be greatly reduced.

Fiscal Policy.

Now let us look at some of our pre-war practices in relation to this problem of technique and production costs.

Capital Assets. If we are to succeed in our efforts at building up export trade to anything like the volume that seems necessary at competitive prices, one basis must be the maintenance of capital manufacturing assets at the highest technical level. Plant that falls below a certain level of efficiency when measured by the yard-stick of costs, must be ruthlessly scrapped and replaced by something better. So great has been the advance of machine tool and process equipment in the last 50 years that obsolescence is a far greater drain on the resources of a Company than depreciation. Yet sums in addition to standard depreciation allowances, themselves inadequate, set aside to make good the timely replacement of obsolescing plant are treated by the Government as profit in the accounts of the Company and are taxed accordingly. A more pernicious handicap to industry could hardly be conceived. It is in truth a Capital Tax on the competitive equipment of Industry.

I submit that the first claim on the gross earnings of a Company are the funds necessary to maintain its technical and competitive power, and that such funds should be free of taxation.

Excess Profits Tax, devised to take the profit out of war, will prove, in very many cases, to have taken the power to compete and so to employ, out of peace. Firms with a poor E.P.T. standard probably through no fault of their own, have not found it possible to set aside enough reserves to bring manufacturing and process plant up to date and to make good exceptional war depreciation. Nor can they hope to meet transitional trading losses that may be expected. Unless some special scheme of rehabilitation financed by the State is put into force, these firms will have no option but to capitalise their rehabilitation with no compensating increase in earning power, or go out of business. They will in any case be permanently crippled.

Research. The public interest now being taken in Research and the Chancellor's declaration that such operations would be allowed as an expense in the firm's accounts are most welcome. Pure and applied Research are the sources of that technical supremacy in industry and physics which we must regain, after letting it slip through our fingers. The remarkable contribution made by our Research workers, physicists and technicians to the war effort, despite the low output of national effort on Pure Research holds out great promise for a future when our seats of learning are adequately equipped and financed to carry on this work. No other form of National expenditure is likely to return bigger dividends to the nation than this.

What will be important is that our Pure Research Organisations and Universities, having been generously financed, shall be reasonably free to choose the spheres in which they will pursue their studies. If Government assistance means Government control of studies through a Civil Department results cannot be other than disappointing.

Design and Art. In the days of the craftsman, many of our British products were things of great beauty. With the coming of mass production we seem to have lost much of the urge and ability to bring art and beauty into the ordinary equipment of life. Nothing quite parallel to the Design ateliers of the U.S.A. and France exists in Britain, nor have we attempted anything like the experiment carried out so successfully in Germany at the Bauhaus by Dr. Gropius. Here is a serious gap in our Educational System, both artistic and technical. The industrial designer of to-morrow must be both artist and process engineer. His training will be long and costly and the rewards to which he can aspire must be commensurate with this.

The recent announcement that a Government Committee would examine the problem is welcome. It is, in my view, in the highest interest of industry to reinforce, in its evidence before this body, the brave work done by the Royal Society of Arts for long past in its advocacy of a real wedding between Art and Industry.

The Wage Structure in Engineering.

Assuming that the technical and scientific foundations of the Engineering Industry are well and truly laid and that markets are there for our goods if we are competitive, we are brought back inescapably to costs of manufacture, and to the wage structure in the industry.

You will all be familiar with the agreement between the Engineering Employers Federation and the Trade Unions on this matter.

It is a curious document. That part of it dealing with procedure to avoid disputes lays obligations on both parties and has on the whole met its objects in major disputes. It has not been effective in stopping unauthorised sectional stoppages.

That part of it dealing with wages lays obligations on the employer to pay certain categories at certain rates without in return any warranty expressed or implied from the Trade Unions that those for whom they negotiate shall reach a certain standard of competence and observe reasonable discipline. To encourage payment by results it has been agreed that such workers shall be paid a bonus over and above their basic rate. The definition is that a worker of average ability shall be able to earn, at the rates fixed, $27\frac{1}{2}\%$ above his basic rate. Gentlemen, what a yardstick by which

to measure earnings—a phrase that has never been defined and that is in truth, undefinable!

Inevitably there has grown up a practice of going slow when the rate is being arrived at, and not too fast when it has been agreed, in the mistaken fear on the part of organised labour that the management may attempt to reduce the rate when the maximum earning power of the worker is disclosed.

But the war has removed any significance the agreement ever had. Lieu bonuses have become the almost universal rule among all workers; and in the face of interruption and other conditions arising out of the war basic rate plus 27½% has become virtually a guaranteed minimum wage irrespective of output.

It would be difficult, if not impossible even if it were desirable, to restore the spirit of the pre-war arrangement, and so both Unions and Employer would be wise, I submit, so seek a new basis on which to meet the problems of the future. A basis can be found, I believe, combining utilisation of plant at a high level of efficiency with a high level of wages to the workers—both essentials in economical production and a contented body of men and women.

I am expressing my personal views when I say that in the difficult times ahead there must be a much more realistic approach by the Trade Unions to this problem. Personally I should like to see the words "Semi-skilled" and "Unskilled" dropped to be replaced by the word "operative" with a suitable pre-fix. The Trade Unions and the Employers should try to reach agreement on a series of tests to establish a minimum level of dexterity in each category, any worker falling below this standard to be treated as a learner and paid at a lower rate. Jobs should be rate fixed on this minimum basis so that the qualfied worker who cannot exceed the standard shall earn his basic rate over the standard working week. For those who can exceed this minimum, I should like to see a bonus curve, rising above the straight line that will reward them adequately for the economic value of high output coupled with lower costs.

Equally it is essential that the Trade Unions warrant the reasonable discipline of those for whom they negotiate. The Engineering Industry has gone through a phase between the wars when it seemed as if the desire of what I may term the junior partner in the Trade Union Hierarchy was to bring about anarchy in Industry. Management was attacked and reviled on the most flimsy protexts; labour was exalted in propaganda as the source of all wealth; and "ca canny" was meritorious in the false belief that the total of employment was thereby increased.

That phase, I hope, has passed. For the truth is inescapable that in the Engineering Industry it is only after the Research Worker, the Designer, the Production Engineer and Planner

and the Craftsman, have laid the foundations well and truly and someone has supplied the capital equipment that the mass of workers can be employed at all.

Those who have the habit of thinking and planning ahead would welcome a statement from the Unions that, in this sense, it is their intention to set their house in order.

The Future of Joint Production Committees. The Joint Production Committee, except for those few organisations that had already created a Workers' Council as a buffer between Management and labour, is a war time growth. Generally speaking it has been a great success and many of us would deplore its disappearance. I have no doubt that the wit and wisdom of labour and employer will find means to weld it, perhaps in some new form, into the post-war structure of the Engineering Industry.

Higher Management. To-day the first aim must be to restore to Britain that technical and commercial leadership that we once enjoyed. If we succeed, great national good will follow. But to restore that there must be reborn in Industry that leadership of the early times, technically informed, with visions firmly founded on knowledge, not only of the technique of its own Industry, but of scientific discoveries as a whole. The emphasis for many years past has been on the financial, accounting and political aspects of direction. Not thus shall we resume our leadership.

Gentlemen, I have dwelt on only a few of our post-war problems. You could all multiply them many times. Seldom have I suggested an answer. The time is not yet. But I deem it the duty of us all to try to crystallise these problems without fear of giving offence or hope of reward. Wise answers will once again give full scope to those grand qualities that are the blood and tissue of this nation.

But these qualities, handed down to us from our forbears, will fail us unless we add to them moral and spiritual values that cement the whole into a national crusade. If the time comes when after a long and weary day we can say "I have given of my best, I could have done no more" and if that is the measure of our self-respect, then I have no doubt we shall regain in due course that moral and industrial leadership of the world that is our birthright.

Annual Report and Accounts.

The President then called upon Mr. H. A. Hartley, the retiring Chairman of Council, to present the Accounts and the Annual Report of the Council, which included the Annual Report and Accounts of the Research Department for the year ending 30th June, 1944.

Mr. H. A. Hartley, in presenting the Annual Report referred to what might be considered one of the most momentous years in

the life of the Institution. As members would be aware, the registered office of the Institution had been damaged by enemy action in March, but the difficulties were gradually being overcome. The first-aid repairs were now almost completed, and it was hoped to have the use of the Council room for meetings in the near future.

Membership.

Many applications for membership had been received, and the membership had increased by 864. During the two years he had been Chairman of Council the number of members had increased by approximately 50%, and to-day the membership of the Institution numbered approximately 5,000.

Honours conferred on Members.

It was very gratifying to find that a number of members had received official recognition for their services to production, and he would specially refer to the knighthood conferred upon Sir George Bailey, a past-President of the Institution. (Applause).

Section Activities.

Mr. Hartley said it was very pleasing to know that the Sections continued to be so active, and more meetings had been held this year than at any other period in the past. New Sections had been inaugurated at Wolverhampton and Halifax, and Sub-Sections at Lincoln and Derby, whilst in addition the formation of a Sub-Section at Shrewsbury was proposed. It was particularly encouraging to note that so much enthusiasm existed among the younger members, and this was evidenced by the desire of the Wolverhampton, Manchester and North Eastern Sections to form their own Graduate Sections. In addition, the Council had agreed to form a Sub-Council in Australia which would operate under the main Council in London.

Research.

Great attention had been given during the year to the future position of the Research Department. Many members would be aware that negotiations were proceeding with the Machine Tool Trades Association for a link up with them and also with other bodies concerned with production engineering so that the Research Department would be able to serve the country in a very real way. The Department of Scientific and Industrial Research have been approached with a view to their taking an interest in the Research Department, and they were very willing to do so provided it was linked up with industry. The Council looked forward to the day when this recognition would be forthcoming, and hoped that this would not be long delayed.

Education.

One of the most important subjects of the year had been the Government's proposals for post-war education. The Council had been alive to the importance of training young engineers, and in that connection he mentioned that the Institution had been invited to give evidence before a Committee of the Ministry of Education presided over by Lord Eustace Percy. Mr. Hartley also referred to the record number of candidates who had passed the Institution's Graduateship Examination, and the Higher National Certificate in Production Engineering, and to the fact that as soon as practicable after the war the Council proposed to introduce an Associate Membership Examination.

Mr. W. F. Dormer seconded the motion.

The President then put the motion for the adoption of the Report and Accounts, with an addendum, to the meeting, and the motion in this form was carried.

Election of Auditors.

Mr. Kidd proposed that Messrs. Gibson, Appleby & Co. (Chartered Accountants) be elected Auditors for the ensuing year. This was seconded by Mr. Braid, and the motion was carried unanimously.

Vote of Thanks to the President.

Mr. Thornycroft, in moving a vote of thanks to the President for his Address said that the Institution was fortunate in having as its President, Sir Robert McLean, who had studied the varied aspects of production engineering, and whose great knowledge would be of value to the Institution during the next few years when very many difficulties would have to be faced. It would be seen from his Address that the President was a man of vigour, and the Institution would need the best advice that it could obtain if it were to improve its position in the years to come.

The vote of thanks was carried unanimously and with acclamation, and was briefly acknowledged by the President.

Vote of Thanks to the Retiring President.

In proposing a vote of thanks to the retiring President, Mr. Blackshaw regretted that Sir Ernest Lemon had not been able to carry out the very many duties in connection with his office of President as actively as he knew Sir Ernest Lemon would have wished. He extended to Sir Ernest Lemon the best wishes of the members for better health in the future.

The vote of thanks, which was carried unanimously, was suitably acknowledged by Sir Ernest Lemon.

Vote of Thanks to the Retiring Chairman of Council.

Mr. Hales said that Mr. Hartley had had the most difficult years of office that any Chairman of Council had every had, bearing in mind the enemy air raids periods, the death of the late General Secretary, and the various difficulties which had occured during the past two years, including staff difficulties due to the war. He expressed the hope that Mr. Hartley's wise counsel would be available to the Institution for many years to come.

The vote of thanks was carried unanimoulsy and with acclamation.

Vote of Thanks to the Hon. Secretaries.

Mr. Bowen proposed a very hearty vote of thanks to the Section Hon. Secretaries to whom the Institution owed a debt of gratitude.

The vote of thanks was carried enthusiastically.

The proceedings then terminated.

Research Department: Production Engineering Abstracts

(Prepared by the Research Department.)

NOTE.—*The Addresses of the publications referred to in these Abstracts may be obtained on application to the Research Department, Loughborough College, Loughborough. Readers applying for information regarding any abstract should give full particulars printed at the head of that abstract including the name and date of the periodical.*

HEAT TREATMENT.

Heat Treatment of Gears, by R. Hamilton Watt. (*Power Transmission, November, 1944, Vol. 13, No. 154, 3 pp.*).

Part II. This part is mainly concerned with the principles and applications of the Shorter and Tocco processes. There are notes on the air hardening of gears subjected to high stress and centrifugally casting bronze gears to improve their properties.

High-Frequency Heating, by A. G. Robiette. (*Met. Treatment, Summer, 1944, Vol. 11, No. 38, 8 pp.*).

Considers fundamental principles and equipment; applications (surface heating for hardening, for fusion of an electro-deposited coating, hot machining operations; localised heating for tempering a portion of an article; soldering and brazing; heating throughout a mass, e.g., for heating billets and sintering powdered metal compacts); and economics of high frequency heating.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Induction Heating. (*Sheet Metal Industries, November, 1944, Vol. 20, No. 211, 9 pp., 13 figs.*).

Part IV: Hardening technique and the employment of induction heating. Surface hardening by pack-carburising, liquid carburising, and gas carburising; nitriding, flame hardening, hard surfacing, and chromium plating. The advantages of induction hardening. The metallurgy of the process.

ADMINISTRATION.

Administrative Engineering in the U.S.A., by D. Tiranti, and G. A. Whipple. (*Aircraft Engineering, November, 1944, Vol. XVI, No. 189, 3 pp.*).

This subject is definitely catered for in educational curricula in the United States. Nineteen universities and colleges have an accredited curriculum in industrial engineering, and in ten other cases the subject is given as an optional part of the mechanical engineering course. Some of the curricula given at different universities are examined; these contain subjects such as: gauges, job evaluation, management of research and development, industrial management, wage incentives, production control, motion study, time study and research, and research in administration and management.

BELTS, ROPES.

Dual Belts, by H. Stuart Jude. (*Power Transmission, November, 1944, Vol. 13, No. 154, 6 pp., 4 figs.*).

The author discusses the application of double belts as the solution to specific power problems and describes : the preparation and use of double leather belts ; rider belts ; and combination belts.

Variable Speed Cones, by E. V. Paterson. (*Mechanical World, 3rd November, 1944, Vol. 116, No. 3018, 4 pp., 5 figs.*).

An investigation of their properties. Length of belt required. Velocity ratios with simple speed cones. Velocity ratio proportional to belt displacement. Belt displacement proportional to reciprocal of velocity ratio. Mathematical analysis.

Faults with Pulleys, by Edward Ingham. (*Power Transmission, November, 1944, Vol. 13, No. 154, 3 pp., 2 figs.*).

Characteristics of different types of pulleys. Design practice. Test for balance. Covering belt pulley rims with suitable material to prevent slip. Inspections.

COOLANTS AND LUBRICANTS.

The Lubricar. (*Machine Tool Review, September-October, 1944, Vol. 32, No. 193, 3 pp., 4 figs.*).

The Lubricar is a truck with compartments for fresh and waste oil, etc., which permits the adoption of a system for the regular and efficient lubrication and servicing of machine tools.

Oil as a Grinding Lubricant and Coolant, by A. Rousseau. (*Machine Tool Review, September-October, 1944, Vol. 32, No. 193, 2 pp.*).

There is at present a great deal of interest in the use of oil as a grinding lubricant and coolant stimulated by the wide introduction of production thread grinding machines and the widespread interest in improved surface finishes. In view of conflicting reports it was decided to study the available information and data. Oil is a better lubricant and probably increases the stock removing capacity of any grinding wheel. Water is the better coolant and where the rate of stock removal is considerable permits the use of a faster cutting rate. Little or no progress has been made in the use of oil on general cylindrical and surface grinding machines. The article concludes with a summary of the features of oil and its limiting factors : (a) heat, (parts are hotter due to inability of oil to carry away heat as readily as water) ; (b) fumes and spray ; (c) contamination (due to slower settling of chips) ; (d) loss from splash. Methods of avoiding or overcoming objectionable features are suggested.

EMPLOYEES, APPRENTICES, ETC.

The Art of Leadership, by Major R. A. C. Radcliffe. (*The Engineer, 20th October, 1944, Vol. CLXXVIII, No. 4632, 2 pp.*).

A discussion of leadership problems under the headings : mutual confidence, discipline, efficiency, team spirit, personal interest in each man and unselfish work for his welfare.

The Mechanical Engineer and His Training, Part 1, by S. H. Stelfox. (*Engineering, 17th November, 1944, Vol. 158, No. 4114, 2 pp.*).

The author critically reviews present methods of training and points out various dangers. He criticizes some aspects of the State Bursary scheme, as it encourages boys to follow the university course before there is any evidence of their suitability for it ; he considers the choice should be made from boys who have already had some experience of the industry and are determined to make it their profession. He stresses the lack of co-ordination between academic and practical training and indicates that there is often a failure to understand just what qualifications are required for various types of employment.

Discussion on Technical Training, Including Training for Management. (*Transactions of the Institution of Engineers and Shipbuilders in Scotland, December, 1944, Vol. 88, Part 2, 23 pp.*).

This discussion was based on these four questions :

(1) Is the present method of apprenticeship satisfactory, and for what type of job does it suit the apprentice ? Should any reconsideration be given to the length of time of apprenticeship ?

(2) Assuming, as we must do, that technical education exists to serve industry, how can we best make use of it to produce a labour force of the highest technical quality ?

(3) Having regard to the importance of the human factor in industry and to the fact that better results will always accrue from leading rather than driving, is it desirable that there should be training in management for foremen and the higher grades, including that of labour manager ?

(4) What training exists or should exist to give the able technical man an understanding of business organization in order to fit him to rise to the highest posts ?

The views expressed in sixteen contributions are recorded, and form a very useful survey.

The Problems of a Pioneer Job, by Margaret Brown. (*Labour Management, October-November, 1944, Vol. XXVI, No. 276, 3 pp.*).

The difficulties of introducing a personnel management system. The aim of personnel management. Laying the foundations. Widening the scope of the work. Gaining the confidence of employees and management.

The Relationship of Time-Study to Personnel Management, by E. H. Lewis, (*Labour Management, October-November, 1944, Vol. XXVI, No. 276, 4 pp.*).

The uses of time study. Time study and personnel policy. Explaining the purpose of time study to workpeople. The importance of job methods.

FOUNDRY. CASTINGS.

Recommendations to Buyers of Castings. (*A.F.A. Booklet No. 43-45, 25th October, 1943, 8 pp., B.N.F. Serial 27,420*).

Data required for accurately estimating casting costs. A revision of the 1931 edition.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Centrifugal Casting of Steel, by S. D. Moxley. (*A.S.M.E. Transactions (U.S.A.), October, 1944, Vol. 66, No. 7, 8 pp., 24 figs.*).

This relatively new method of casting is being applied to great advantage in the economic production of high-quality engineering parts. The three methods generally used are true centrifugal casting, semicentrifugal casting and centrifuging. The author gives a comprehensive description of each method, the work for which it is best adapted, the machine used, details of moulds, and physical properties of the resulting products. Included in the products of these processes are radial-engine cylinder barrels, wheels, gear blanks, and other circular shapes.

Centrifugal Casting of Aircraft Engine Cylinder Liners. (*Machinery, 9th November, 1944, Vol. 65, No. 1674, 7 pp., 11 figs.*).

The Ford Motor Company's production of cylinder liners for Pratt & Whitney 2,000 h.p. aircraft engines by centrifugal casting is carried out completely on a mass-production basis. The arrangement of melting furnaces, pouring facilities, conveyorized centrifugal casting line, mould cooler, and pre-heater is shown. In the centrifugal casting there is only a small percentage of excess metal and little rough machining is required. In the forging, starting with solid steel blocks, the rough machining must remove 51% of the metal. Under hydraulic tests, the strength of centrifugally-cast cylinder liners made of S.A.E. 4140 steel has been found to be superior to that of forged liners.

Magnetic Powder Inspection of Large (Steel) Castings, by J. F. Cotton. (*Amer. Foundrymen's Assoc. Preprint 44-45, April, 1944, 23 pp., B.N.F. Serial 27,397*).

The purpose of this paper is to evaluate quantitively the variables in magnetic powder inspection and to show that a standardised technique must be established before standards of magnetic powder inspection can be prepared.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Magnesium Castings by Dodge Chicago Plant, by W. G. Gude. (*Foundry, August, 1944, Vol. 72, No. 8, 6 pp.*).

A general description of the magnesium foundry of the Dodge Chicago plant (50,000 lb. magnesium melted daily). A mechanised foundry, casting in core assemblies using silica sand bonded with oil and cereal binder and sprayed with a fluoride solution after baking. Asbestos sleeves are used extensively to line feeder cavities. Used sand is reclaimed by burning out the binders and removing fines by air currents.

(*Communicated by the British Non-Ferrous Metals Research Association*).

GEARS.

Letter Symbols for Gear Engineering, Parts I and II. (*The Machinist, Reference Book Sheet, 21st October, 1944, Vol. 88, No. 28, 2 pp.*).

This standard has been approved by the American Standards Association. The reference sheet deals with its purpose, symbols and subscripts, and typography.

MACHINE ELEMENTS.

Pictorial Drawing by Trimetric Projection. (*Machine Shop Magazine, November, 1944, Vol. 5, No. 11, 4 pp., 6 figs.*).

Perspective, isometric, and " trimetric " projection. How to construct a trimetric scale. Constructing an ellipse.

MACHINE TOOLS AND MACHINING.

Standard Speeds for Machine Tools, by Dr. G. Schlesinger. (*The Machinist, 25th November, 1944, Vol. 88, No. 33, 3 pp.*).

The standardization of speeds was accepted at the last pre-war meeting of the I.S.A., and the writer gives a condensed outline of the system. Standardized speeds, when correctly applied, facilitate (1) the design of the machine tool, (2) its manufacture by the maker, (3) the drive by (a) motor or (b) by countershaft, and (4) the most economic exploitation of the machine tool by the user. The common ratio R40 $= \sqrt[40]{10} = 1.06$ is selected as the basis of a proposed system and this is then described.

Swiss Machine Tool Construction, by Prof. Nettler. (*The Engineer, 3rd November, 1944, Vol. CLXXVIII, No. 4634, 2pp., 6 figs.*).

Part I : In the Swiss machine tool industry there is a tendency to further the construction of the multi-purpose machine and to give up making the single-purpose machine. The articles deal with a number of the more modern machine tools and accessories for machining by cutting and by non-cutting methods. Among the machines described are : planing and shaping machines ; milling machines, including one with a circular out-board support, giving an enclosed rigid frame ; and grinding machines. Particular attention is paid to driving, feed, and control systems ; fairly full data are given of speed and feed ranges, etc.

Machining of Light Alloys with Diamond Tools. (*Light Metals, September, 1944, Vol. 7, 7 pp.*).

General article summarizing the advantages of diamond as cutting material, referring in particular to the machining of aluminium alloy pistons ; list of references.

(*Communicated by Industrial Diamond Review*).

The Machining of Aluminium Alloys, by A. J. T. Eyles. (*Mechanical World, 24th November, 1944, Vol. 116, No. 3021, 5 pp., 6 figs.*).

The general properties of aluminium alloys which are of importance in machining are : high thermal conductivity ; lightness ; and the low modulus of elasticity and shear modulus. It is essential that the cutting edges of the tools be keen, smooth and free from grinding wheel scratches, burrs or wire edges. Some form of lubricant or cooling fluid is desirable. A satisfactory compound for general purposes consists of a mixture of lard oil and paraffin in varying proportions, but when machining aluminium alloy castings, soluble cutting oils are generally preferred. Suitable clearance and rake angles are given for lathe tools and milling cutters, etc Speeds, feeds and recommended practice are given for milling, spar milling, planing and shaping, grinding, drilling, reamering, tapping, screw cutting and sawing.

Effect of Structure and Composition on the Machinability of Copper Alloys, by D. K. Crampton. (*Met. Progress, August, 1944, Vol. 40, No. 2, 10 pp.*).

Discusses relation of machinability to nature of dispersed phase, composition of alloy in major constituents, previous cold work (temper draw) and nature of cutting operation. Reference made to (among other things) leaded brasses and bronzes, free-cutting brasses, effect of Te, etc.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Cutting with Carbides. (*Machine-Tool Review, September-October, 1944, Vol. 32, No. 193, 3 pp., 10 figs.*).

The introduction of turning tools having negative rake has emphasised the necessity of correct technique in the preparation and application of the tools. Tool shapes should be as simple as possible so that chips of ribbon form are produced at the tool nose, though these may be broken subsequently. High speed cutting is essential as this has an important bearing on proper chip flow. Modern tangential parting off tools with negative rake are showing remarkable production times. No fixed rules can be given for the design of chip breakers. They must be very carefully designed otherwise they cause a great amount of heating and absorb much power. Negative rake tools operate very successfully on interrupted cuts. Careful grinding and lapping are essential, and the reasons for this are indicated. Where coolants have to be used care must be taken in methods of application. The surface finish usually obtained is much better than that obtained from high-speed steel tools and careful control should be maintained on parts which are to be ground.

Correct Use of Twist Drills. (*Production and Engineering Bulletin, November, 1944, Vol. 3, No. 24, 3 pp., 3 figs.*).

This article forms a useful summary of information on twist drills. As well as general recommendations, speeds and feeds for drilling various materials are given.

Methods and Equipment Used for High-Production Grinding. (*Machinery, 9th November, 1944, Vol. 65, No. 1674, 4 pp., 11 figs.*).

It is possible to apply sizing devices to a variety of gauging and measuring problems other than the sizing of simple, straight cylindrical pieces. Among the examples given are the following : grinding a long, thin piece with straight infeed of a wide wheel ; grinding two diameters simultaneously, using two wheels and two visual sizing gauges ; work on aero-engine cylinders and crankshafts ; the complete automatic grinding of four main camshaft bearings ; and grinding small roller-bearing components.

Grinding with Vitrified Corundum Wheels. (*Industrial Diamond Review, October, 1944, Vol. 4, No. 47, 4 pp., 15 figs.*).

An account of a German investigation on the influence of wheel hardness. The main sections of the work were on : (A) The breaking out of grains during vibration-free grinding. (B) The reaction of the grains during grinding. (C) The self-sharpening of grinding wheels. (D) The influence of the truing-feed of the diamond-tool on the formation of surface edges and splinters, and (E) Influence of wheel hardness on the formation of edges and splinters during truing. A critical editorial note is given.

Tips on Slideway Grinding, by T. Smith. (*Machine Shop Magazine, November, 1944, Vol. 5, No. 11, 4 pp., 5 figs.*).

The shortage of skilled personnel and the necessity of accelerating production has resulted in the rapid development of the slideway grinding machine. Frequently the value of the machine is negatived by inaccurate planing and it is recommended that the work coming from the planing machine should be to within an accuracy of 0.004 in. The grinding of a small plain grinder body and its table is used to illustrate, with considerable detail, the methods used. The use of fixtures will greatly assist setting up. In addition to the grinding of cast iron components it is also quite economical to grind steel machine parts.

Calculations in Negative Rake Milling. (*Production and Engineering Bulletin, November, 1944, Vol. 3, No. 24, 2 pp., 1 fig.*).

Methods of determining the number of teeth, permissible depth of cut, and the horsepower required, are described.

High-cycle Milling. (*Machinery, 23rd November, 1944, Vol. 65, No. 1676, 4 pp., 8 figs.*).

The successful milling of aluminium at up to 19,000 feet per minute is being done on standard Sundstrand No. 1 hydraulically-fed Rigidmils in which the regular spindles have been replaced by special spindles driven directly by high-cycle synchronous motors of a water-cooled design giving 20 h.p. at 9,500 r.p.m. The climb-out principle is followed in most cases and cutters with positive rake and helix angles, zero or neutral rake and negative helix angle, and slitting saws are all used. Typical production operations are described.

CHIPLESS MACHINING.

Machining Tolerances Held in Producing Small Stamped Parts. (*The Machinist, 18th November, 1944, Vol. 88, No. 32, 4 pp., 6 figs.*).

Fine finishes and tolerances to 0.0005 in. are being attained where stampings are used to replace forgings and castings. One of the most important developments has been the increased use of coining and sizing and machine-like finish as well as close tolerances can be secured by cold-coining parts made from chrome, molybdenum, aluminium and stainless steel alloys. Several examples are dealt with, and details given of tolerances obtained.

MANUFACTURING METHODS.

Exacting Production Methods on the Aircraft Gyropilot. (*Machinery, 30th November, 1944, Vol. 65, No. 1677, 9 pp., 15 figs.*).

Principles of gyropilot. Machining operations including grinding, lapping and diamond boring and turning on high precision components to very fine limits.

Production of the Merlin Engine. (*Machinery, 16th 23rd November, 1944, Vol. 65, Nos. 1675, 1676, 10 pp., 16 figs.*).

Operations on supercharger parts, gears, and light alloy castings.

The Gipsyqueen II, by J. A. Oates. (*Aircraft Production, November, 1944, Vol. VI, No. 73, 15 pp., 48 figs.*).

Part II. Machining the pistons and connecting rods. Forging, heat-treatment and subsequent operations on the crankshaft.

Hot Plug Production, by Clifford T. Bower. (*Machine Shop Magazine, November, 1944, Vol. 5, No. 11, 9 pp., 10 figs.*).

The hot plug of a high-speed diesel engine has a hemispherical recess and a kidney shaped orifice, and is made from a high nickel chrome valve steel, so that its manufacture presents many problems. The article describes the methods which have been evolved. Set-ups, fixtures and gauges are described and illustrated.

MATERIALS.

Ceria : A New and Little-known Abrasive. (*Industrial Diamond Review, October, 1944, Vol. 4, No. 47, 1 p.*).

The development and practical trials are outlined. It is claimed that, compared with rouge, ceria is 30 to 60% faster, produces very few burns and few sleeks and scratches, and in the production of flats, has less tendency to give rolled edges.

Rubber Applications in Engineering, by A. Garrard. (*Machinery, 16th November, 1944, Vol. 65, No. 1675, 6pp., 12 figs.*).

Characteristics of the Metalastik process, and its application to shock and vibration isolation, mountings or supports, and flexible couplings.

MEASURING METHODS AND INSPECTION.

Aerotool Metrology, by H. Grafton. (*Aircraft Engineering November, 1944, Vol. VI, No. 73, 6 pp., 11 figs.*).

Part II : The application of optical measurement to the manufacture and inspection of large assembly equipment is described in detail with special regard to the system of " metrology triangulation " developed by the author for which results showing a remarkably high degree of precision are claimed.

The Spectrograph as an Inspection Tool, by J. D. Graham and H. F. Kincaid. (*Machine Shop Magazine, November, 1944, Vol. 5, No. 11, 4 pp., 2 figs.*).

By burning a metallic specimen that is to be analysed, the light rays produced are separated and recorded. The rays can be identified with particular elements and so an analysis of the specimen is obtained. Burning is affected by the production of an electric arc between the specimen and a pure carbon electrode. This article describes spectrographic analysis and compares two methods. Requirements for the successful application of this method to industrial analysis are given.

RADIOGRAPHY.

Fluoroscopic Tests. (*Aircraft Production, November, 1944, Vol. VI, No. 73, 2 pp., 2 figs.*).

Though inferior to radiography in some respects, as a means of rapid visual examination the process is extremely valuable, and can usefully be employed for the selection of castings for further test by radiography. A.I.D. requirements are indicated, and screening equipment, and the perspectrosphere, with their uses, are described.

RESEARCH.

Applied Research, by Harry R. Ricardo. (*The Engineer, 10th November, 1944 Vol. CLXX VIII, No. 4635, 2 pp.*).

Part III: Extract from the presidential address, Institution of Mechanical Engineers. Great care must be taken with instrumentation. It is best to have a few simple and well understood instruments. Calibration in absolute terms is essential and students should be trained to realise its importance. There is a crying need for a closer liaison between the research worker and the industrialist. There are faults on both sides, and some on the side of the research worker are outlined. The research worker often makes little or no attempt to understand the industrialist's problems or point of view and may be at fault in the manner in which he presents the results of his work. It is essential that the applied research worker should have a fairly intimate

knowledge of actual design and production problems. The successful inventor is he who applies his knowledge, whether it be derived from practical experience or from academic research, to the fulfilment of some need in the right way and at the right time. Public opinion is now demanding that vast sums shall be spent on research in the post-war era. This ought to be spent on the production and training of skilled research workers rather than on the equipment of large laboratories, but there is also a need for certain large scale and very costly items of test equipment, such, for example, as a full-sized high-altitude wind tunnel for aircraft, or a large tank for shipping. In conclusion the relative responsibilities of the State and private enterprise are discussed. (Similar extracts appeared in *Engineering*, Vol. 158, No. 4112, 3rd November, 1944, and *Power Transmission*, Vol. 13, No. 154, November, 1944).

SHOP MANAGEMENT.

Motion Study. (*Production and Engineering Bulletin, November, 1944, Vol. 3, No. 24, 3 pp., 2 figs.*).

Part I. Motion study is directed towards the prevention of waste of human effort. Time study is undertaken to establish a basis for payment according to output. The purposes of motion study are elaborated.

Load Calculation for Planning Purposes, by W. Metcalfe. (*Machinery Lloyd, 25th November, 1944, Vol. XVI, No. 24, 5 pp., 2 figs.*).

Plant loading is the basis on which machine scheduling, synchronisation of manufacture, quotation of delivery dates, labour demand and other features of production control rest. There are several methods of carrying out the investigations necessary for the establishment of plant load control. The time study method gives appreciably accurate results, but its use requires considerable thought and preparatory work. A second method is that of estimating from drawings. Although not quite so accurate as the f ner method, it has the advantages of avoiding any possibility of labour trouble. A third method of securing plant load data is to work from established piece rates. It is in general not quite so accurate as either of the two former methods, but this is not a matter of great consequence. The use of activity factors covers various disturbing elements. An example illustrates the method of determining and applying the activity factor to find the load index. Load summation consists of two major parts : the addition of new load and the subtraction of executed load. Several methods are described. Continual checking over an extended period against actual performance is most advisable, and it may be eighteen months to two years before the values are truly representative of what can be accomplished. Many useful lessons can be learned from a scrutiny of loading charts, and these are indicated. To secure the full benefit it should be allied to a comprehensive scheme with material control, machine scheduling, and objective progressing.

SMALL TOOLS.

Use of " Cushions " Adds to the Life of Tipped Tools, by Leo J. St. Clair. (*The Machinist, 18th November, 1944, Vol. 88, No. 32, 3 pp., 5 figs.*).

The use of a thin copper " cushion " between the tool shank and tip is credited with increasing tool life as much as five times. The author outlines his theory of cutting action. Tests were run on a tool that was able to machine several hundred pieces between grinds, and the tool was carefully examined after each piece. These tests showed that the first phase of tool dulling can be explained by minute chipping of the cutting edge, and that abrasion is the second phase. Tipped tools therefore gave better results than solid tools

since the cushioning effect of the brazing delayed initial chipping. This cushioning effect was increased by putting a thin sheet of copper below the tip ; increased performance was obtained with tools of the same hardness, and even better results obtained with tips of higher hardness which previously had broken down rapidly. Applications are described all of which incur interrupted or irregular cuts.

Economical Use of Diamond Abrasive Wheels for Grinding Cemented Carbide Hard Metals. (*Industrial Diamond Review, October, 1944, Vol. 4, No. 47, 2 pp., 2 figs.*).

Data sheet. General recommendations for the use of resinoid bonded and metal bonded diamond wheels.

Diamond Tools for Plastics. (*Plastics, 1944, Vol. 8, 7 pp.*).

Discussion on the merits of diamonds as cutting medium, especially for high precision work ; limitations, special applications ; calendar rollers, pipe stems, etc. 2 tables, 11 illustrations, references.

(*Communicated by the Industrial Diamond Review*).

Repair and Maintenance of Tools, by T. B. Jefferson. [*Welding J. (J. Amer. Weld. Soc.), June, 1944, Vol. 23, No. 6, 6 pp.*].

Gives several examples of the means by which jointing processes are being used to reclaim tools. Particular attention is given to silver alloy brazing and atomic hydrogen welding.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Making Zinc Alloy Aircraft Forming Dies, by G. E. Stedman. (*Metals and Alloys, July, 1944, Vol. 20, No. 1, 5 pp. ; Met. Ind., 20th October, 1944, Vol. 65, No. 16, 2 pp.*).

Outlines practice of North American Aviation Co., Kansas City, in production of Kirksite (Zn-base alloy) forming dies.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Drawing Office Practice in Die Design, by H. K. and L. C. Barton. (*Machinery, 30th November, 1944, Vol. 65, No. 1677, 4 pp., 6 figs.*).

The authors outline a procedure for drawing offices devoted to die-casting die design under these headings : Preliminary sketch. The layout drawing. Ejector gear. Detailing the die. Impression details. A system of dimensioning. Marking out the die.

STANDARDISATION.

Conferences on United States, Canadian and British Standards for Screw Threads. (*Machinery, 30th November, 1944, Vol. 65, No. 1677, 4 pp.*).

The results of these conferences have been published in a report which can be obtained from the Director General of Machine Tools, Ministry of Production, Dept. D.G.M.T., Caxton House East, Tothill Street, S.W.1. This report gives a summary of the various discussions and conclusions reached on truncated Whitworth threads, high duty studs, pipe threads, screw threads for compressed-gas cylinder outlets, Acme threads, buttress threads and instrument threads. The article gives the main points of the discussions and conclusions.

(Some details also appeared in *Mechanical World*, Vol. 116, No. 3020, 17th November, 1944.).

SURFACE FINISH AND SURFACE TREATMENT.

Surface Finish Measurement, by C. Timms. (*Mechanical World, 17th, 24th November, 1944, Vol. 116, Nos. 3020, 3021, 8 pp., 12 figs.*).

Part I: Surface roughness can be divided into two general types, micro-roughness and macro-roughness, caused respectively by the cutting of the tool, tool chatter and vibration. Three main types of recording instruments are in use in this country. Each provides a highly enlarged autographic record of the surface profile, and employs a diamond exploring probe. The Tomlinson recorder is described, examples of records are given, and operating difficulties are discussed; records of four aluminium pistons machined with diamond tools and records of surface profiles produced by different machining operations are also shown.

Part II: The accuracy of surface measurement by recording instruments is limited by the finite radius of the exploring probe, which in practice cannot be made less than about 0.0001 in. owing to the pressure intensity on the point. An interference method of examining external cylindrical parts devised by J. F. Kayser, has been further developed at the National Physical Laboratory for the examination of flat and cylindrical surfaces. This method is extremely suitable for the examination of the finish of slip gauges. The method is described and its possibilities are illustrated by results of tests on three slip gauges and a cylindrical lapped steel surface. The inspection of surface finish may be complicated by the presence of undulations or macro-roughness. Recorders of the normal type have a very restricted length of traverse, and undulations present on the surface may not be recorded due to their comparatively long pitch. An instrument designed by Dr. Tomlinson, for measuring macro-roughness is described and sample records taken with its aid are compared with those taken by the normal recorder. One of the main problems of surface finish measurement is the difficulty in assessing the quality of finish completely in terms of a single number so that the degree of finish can be quoted on a drawing; the uses and limitations of average and r.m.s. values are reviewed. It is concluded that a complete answer to this problem has yet to be found. As the result of experiments at the National Physical Laboratory it is now possible to produce reliable and permanent standards of surface roughness which have various applications in the technique of surface inspection, e.g. for calibrating the magnification and checking the accuracy of reproduction of recording instruments. They are in the form of glass plates each carrying a group of equi-distant etched grooves.

Specification Needed for Surface Finishes, by R. F. Mather. (*S.A.E. Journal, 1944, Vol. 49, 1 p.*).

Specifications for surface finish to obtain consistent results on parts subjected to fatigue stresses. Vapour blasting is the only means of obtaining a smooth yet compressed surface.

(*Communicated by Industrial Diamond Review*).

Abrasive-Liquid Blast Produces Hone Finish, by A. H. Eppler. (*Product. Eng., July, 1944, Vol. 15, No. 7, 1 p.*).

Outlines vapour blasting or liquid honing, a process which consists of discharging an emulsion containing a finely powdered abrasive (mentions a decomposed siliceous rock) against metal surfaces at high velocity by means of compressed air. Discusses advantages of method and applications (e.g., for deburring in the interior of intricate castings; preparation for electroplating or anodising).

(*Communicated by the British Non-Ferrous Metals Research Association*).

The Pickling of Steel, by E. W. Mulcahy. (*Sheet Metal Industries, November, 1944, Vol. 20, No. 211, 4 pp., 3 figs.*).

Part 1 : General considerations of pickling plant design, and the properties of materials used in pickling plant manufacture. Lead, timber, rubber, bitumastic compounds, phosphor bronze, silicon iron, monel metal, silicious cement and vitrified blue brickwork.

Electroplaters Discuss Industrial Finishing Methods. (*Iron Age, 6th July, 1944, Vol. 154, No. 1, 20 pp. ; 13th July, 1944, Vol. 154, No. 2, 7 pp. ; 20th July, 1944, Vol. 154, No. 3, 16 pp.*).

Report on papers read at 32nd Annual Convention of the Society : W. Blum, " Electroplating and the War " (6th July, pp. 75-76) ; H. Narcus, " Plastics and Plating on Plastics " (6th July, pp. 76-78) ; D. A. Cotton discussed practical aspects of hard chromium plating (6th July, pp. 78-79) ; T. G. Coyle " Porous Chromium Plating, its Principles, Procedures and Operating Practices " (6th July, pp. 79-80, 152,154, 156-157) ; C. A. Zapffe and C. L. Faust " Relation of Defects in Electroplate to the Gas Content of the Basis Metal " (13th July, p. 63) ; A. G. Taylor described the Iridite process (13th July, pp. 63-64) ; B. B. Knapp, "A Rapid Determination of Copper in Nickel Plating Baths " (13th July, p. 64) ; L. G. Tubbs, " Dyed Anodic Coatings on Aluminium Produced by the Chromic Acid Process " (13th July, pp. 64-65) ; W. S. Murray gave techniques for plating indiam (13th July, pp. 65, 134, 136, 138) ; M. B. Diggin and G. W. Jernstedt, " Bright Alloy Plating (20th July, pp. 138, 140, 142) ; A. Logozzo, " Hard Chrome Problems " (20th July, pp. 63-64) ; F. K. Savage, " Electroforming Techniques " (20th July, pp. 64-67) ; B. Martin, " Stress in Electrodeposition of Nickel " (20th July, pp. 67-68) ; J. E. Starek, "Anodising (Anozinc) and Other New Coatings on Zinc " (20th July, pp. 68-69, 128, 130, 132) ; F. P. Summers, " Dyestuffs " (from the standpoint of colouring anodic coatings on Al) (20th July, pp, 132, 134) ; A. R. Goodkin on anodising Al (20th July, pp. 134, 136, 140, 142, 144, 146).

(*Communicated by the British Non-Ferrous Metals Research Association*).

Electrolytic Methods of Polishing Metals, by Dr. S. Wernick. (*Sheet Metal Industries, November, 1944, Vol. 20, No. 211, 5 pp., 3 figs.*).

Part V : The electrolytic polishing of aluminium. Consideration of reflecting qualities and reflectivity. Theory of anodic oxidation of aluminium.

Rapid Anodising and Painting of Aircraft Parts (Aluminium Alloys), by H. Chase. (*Metals and Alloys, February, 1944, Vol. 19, No. 2, 4 pp.*).

This article shows extent of mechanisation used for rapid and effective anodising (chromic acid) and subsequent spray painting of aircraft parts in the plant of Eastern Aircraft, General Motors Corp., Trenton, N.Y.

(*Communicated by the British Non-Ferrous Metals Research Association*).

Infra-Red Heating. (*Aircraft Production, November, 1944, Vol. VI, No. 73, 6 pp., 12 figs.*).

The three main types of paint and their drying characteristics are briefly described with particular reference to the effect of temperature. The advantages of infra-red drying are most marked when large numbers of the same object have to be treated, and where each article can pass through the oven without being shadowed by its neighbours from the walls of the tunnel. Sources of infra-red rays, the determination of suitable intensities of radiation, methods of distribution of radiation, and the characteristics of absorption of radiation are discussed. Medium temperature, high temperature, and experi-

mental units are described. Finally the relative merits of gas and electric equipment are considered. A useful feature of the article is the considerable amount of data given.

TRANSPORT, EQUIPMENT.

Instrument Packing Cases, by F. Postlethwaite. (*Engineering, 27th October, 1944, Vol. 158, No. 4111, 3 pp., 7 figs.*).

Some idea of the severity of damage resulting from ordinary transport can be gathered from the fact that an organisation exists in the United States for testing the suitability of commercial packages, its methods are indicated. Problems in packing instruments, and some of the methods used, are then dealt with, and the author describes investigations carried out with accelerometers. The tests were carried out with an electronic type of accelerometer capable of registering extremely rapid and severe transient shocks. Different types of packing cases containing accelerometers were dropped from various heights and the results studied. As a result further successful tests were carried out with spring-suspension cases and details of the methods of construction etc., are given.

Hand Trucks for Engineering Works. (*Production and Engineering Bulletin, November, 1944, Vol. 3, No. 24, 6 pp., 15 figs.*).

The use of modern hand trucks, many of which have been designed for handling specific jobs, is described.

WELDING.

The Elin-Hafergut Process for Welding Thin Sheet, by H. Hauser. (*Sheet Metal Industries, November, 1944, Vol. 20, No. 211, 4 pp., 6 figs.*).

A description of a process used in Switzerland. The principle of the method is as follows : the sheets of between 1 mm. and 3 mm. in thickness, placed edge to edge, are clamped between two copper bars. The upper bar has a groove cut into it for taking a heavy-coated electrode, the lower bar is provided with a smaller hollow large enough to collect the electrode deposit for making up the opposite bead. The electrode burns automatically in the channel formed by the sheet and the upper copper bar. This arrangement offers many advantages as opposed to manual operation : (1) Obtaining a steady arc yielding an absolutely even deposit of the weld material. (2) Perfect penetration and formation of an opposite bead. (3) Distortion of the sheets is greatly minimised by the strong pressure from the copper bar, a subsequent straightening of the finished work being rarely necessary. (4) Welding takes place in the canal, and practically no air, and hence, no nitrogen or oxygen are permitted to get at the weld. Consequently, the resulting static and dynamic strength properties of the weld are highly satisfactory.

A Survey of the Projection Welding Processes, by R. Bushell. (*Sheet Metal Industries, November, 1944, Vol. 20, No. 211, 10 pp., 37 figs.*).

This summary describes the projection welding of (1) mild steel sheet, with low carbon, low sulphur, and low phosphorus content, and (2) bar of a similar specification for the projection welding of pins and bosses, etc., with a brief reference only to projection welding of other metals. Consistent results with projection welding depend upon a number of main points being observed : (1) Type of projection, and its correct manufacture. (2) Steel specification. (3) Design of component parts. (4) Type of welding machine. (5) Design of projection welding jigs and fixtures ; and these are dealt with in turn.

Production Applications of Flash Welding, by R. Milmoe. (*Welding, November, 1944, Vol. XII, No. 12, 9 pp., 10 figs.*).

A paper originally presented to the S.A.E., dealing with applications to aircraft construction. The advantages of the flash welded joint over the fusion welded joint include better physical characteristics, lower weights, cheaper and faster production, no warping as a result of welding, and less operator skill required. Design considerations are indicated, and tolerances and locating means described. After showing special features of flash welding machines, the author gives, in considerable detail, practical considerations affecting tooling requirements, preparation of parts, machine settings and inspection methods.

The Welding Department, by H. Marquand. (*Welding, November, 1944, Vol. XII, No. 12, 5 pp., 3 figs.*).

This concluding article of a series is concerned mainly with planning, control and supervision.

GENERAL.

The Organisation of British Industry. (*The Engineer, 3rd November, 1944, Vol. CLXXVIII, No. 4634, 2 pp.*).

This extract, from a report prepared by the Organisation of Industry Committee of the Federation of British Industries, and adopted by the Grand Council, advocates extension of the use of trade associations, and reviews their functions, and relations with the consumer and the State.

The Future, by Sir Summers Hunter. (*The Engineer, 3rd November, 1944, Vol. CLXXVIII, No. 4634, 3 pp.*).

An extract from the Presidential Address to the North-East Coast Institution of Engineers and Shipbuilders. Unemployment must be overcome before a stable peacetime system can be assured. In the past, industry has relied too much on tradition, but it is industrial research that will be one of the major factors in post-war industry. Arrangements must be made for the findings of research workers and inventors to be properly utilised. Both shipbuilding and engineering are developing at a pace that will demand a greater knowledge of scientific principles than was expected in the past, and the entry of university men should be stimulated. When the 1944 Education Act comes into operation it will be necessary to revise apprentice training schemes, so that the act should ensure a better educated and trained supply of skilled labour. Craftsmanship may be less widespread in the future, but all those above the rank of machine tender will find it necessary to have a more profound knowledge of their job than ever before.

An Extract of this address also appeared in *Engineering*, 27th October, 1944, Vol. 158, No. 4111.)

Resumption of Export Trade. (*Machinery Lloyd, 25th November, 1944, Vol. XVI, No. 24, 2 pp.*).

A report by the Engineering and Metals Executive Committee of the Manchester Chamber of Commerce. There will undoubtedly be a great pent-up demand for all kinds of engineering products as soon as export again becomes possible. Following this immediate demand there will probably be heavy requirements for the European countries. Furthermore, the developments which have taken place in many parts of the world during the war should provide new markets provided that the work of exploring and developing is energetically undertaken. The Committee urges on H.M. Government a reconsideration of the whole position regarding export trade, with the twofold objective of enabling British exporters to know where they stand, so that they may make their plans and preparations, and of beginning forthwith the process of removing the shackles.

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